

Assam down town University

Curriculum and Syllabus

Bachelor of Science in Forensic Science

OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 1.2

FACULTY OF SCIENCE

July, 2024

PREAMBLE

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured the

course curriculum as per the guidelines of National Education Policy 2020. This document contains

outline of teaching and learning framework and complete detailing of the courses. This document is

a guidebook for the students to choose desired courses for completing the programme and to be

eligible for the degree. This volume also includes the prescribed literature, study materials, texts,

and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated 16th

& 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Downey

Member Secretary, Academic Council

Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving societybetter.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

Programme Details

Programme Overview

B.Sc. in Forensic Science is a 3-year undergraduate programme under Faculty of Science of Assam downtown University, Guwahati, Assam. The main aim of the Programme is to create experts in the field of forensic science with the application of advanced scientific techniques This course targets to develop a platform where students can get to learn and practice about the scientific methodology and techniques that can be used to the field of crime investigation so that justice can be serve to the right person in less time which is the need of the hour for society. A graduate in forensic science course may avail jobs in the Forensic science laboratories, Research and Development, Education, Armed forces and Private sector also.

I. Specific Features of the Curriculum

The curriculum integrates multidisciplinary concepts of forensic science, fostering an indepth understanding necessary for solving complex forensic problems. It emphasizes holistic development through activities that enhance interpersonal skills, adaptability, and teamwork in diverse socio-cultural settings. Additionally, the curriculum promotes global competency by incorporating international standards and offering global certification courses, enabling students to address forensic issues on a worldwide scale. This comprehensive approach ensures that graduates are well-equipped with both technical expertise and soft skills essential for thriving in the forensic science profession.

II. Eligibility Criteria:

Minimum 45% in 10+2 with English, Biology & Chemistry

III. Program Educational Objectives (PEOs):

PEO-1: AdtU forensic science graduates will be well-prepared for successful careers in industry, corporate, research organizations and/or government sectors in one or more of the disciplines/sub-disciplines of forensic science.

PEO-2: The forensic graduates will be academically prepared to apply advanced technologies for analyzing forensic evidence, leading diverse teams and delivering impartial scientific opinions.

PEO-3: AdtU forensic graduates will play a vital role in fostering a safe and vibrant society by serving as forensic experts for crime awareness, with the potential for successful pursuits in higher education in forensic science if pursued.

IV. Program Specific Outcomes (PSOs):

PSO1: Techno-Professional Ability: Apply the comprehensive understanding of multidisciplinary concepts of forensic science with interdisciplinary approaches to address complex forensic problems.

PSO2: Holistic Development: Foster interpersonal ability and adaptability in diverse socio-cultural teams and efficient working in the profession through co-curricular and extra-curricular activities.

PSO3: Global Competency: Ability to address forensic issues and understand international scenarios through global certification courses.

V. Program Outcome:

PO1: Forensic Knowledge: Apply fundamental concepts of basic and applied sciences, criminal laws aspects, forensic science principles and analytical processes with psychosocial aspects in investigation to support the agencies and the criminal justice system.

PO2: Crimes Scene Reconstruction: Examine physical evidence, witness statements, and forensic findings to understand the sequence of evidence, addressing intricate forensic challenges and formulating logical procedural approaches.

PO3: Analysis and Interpretation: Identify and analyze complex forensic problems using standard analytical protocols and methods.

PO4: **Practice-In-Research:** Identify, formulate and analyze forensic problems utilizing evidence-based research to draw logical conclusions.

PO5: Communication: Communicate efficiently with individuals, peers, investigating agencies and other stakeholders, and prepare quality reports to convey findings.

PO6: Code of Conduct: Adhere to the code of conduct and ethical values in the profession.

PO7: Teamwork: Perform efficiently as a member or leader in collaboration with multidisciplinary teams and diverse settings.

PO8: Modern Tool Practice: Recognize and apply appropriate techniques, resources and modern scientific theories with an understanding of scientific principles.

PO9: Lifelong Learning: Engage in lifelong learning staying abreast of advancements in forensic technology and practices.

VI. Total Credits to be Earned: 140

VII. Career Prospects:

Graduates with a B.Sc. in Forensic Science have excellent career prospects in laboratories and research, criminal justice agencies, armed forces, academics etc. They can become Crime Scene Expert, Document Examiner in banks and different sectors, Forensic Scientist, Advisor and Guide to insurance agencies and banks, Academic Profession, Research & development scientist in respective industries, Research (Food & Beverage, medicine and disease research), Food safety department, Narcotics department and Defence sector.

EVALUATION METHODS

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

B. SEMESTER END EXAMINATION:

Time table for end semester examination is published at least 25 days prior to the start of Examination.

I. Pre-Examination:

Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

III. Pattern of Question Papers:

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examinationroom or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.

- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and refixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

C. Credit Point:

It is the product of grade point and number of credits for a course, thus, $CP = GP \times CR$

i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Table 2: Letter Grades and Grade Points

Letter Grade	Grade Points	Description
O	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
C	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

iv. Grade Point Average:

a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight)of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

D. Post-Examination

i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.

- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.

d. Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of	
teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code	Course Title	Course		Eng	gag	em	ent			Maxim	um Mar	ks for	
	N.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSFS1101R	Crime Scene Management	DSC Major	4	0	2	0	0	0	5	40	60	100	200
	2	24BSFS1102R	Crime and Society	MDC	3	0	2	0	0	0	4	40	60	100	200
Ī	3	24BSFS1103R	Indian Constitution & Legal system	VAC	3	0	2	0	0	0	4	40	60	100	200
ster	4	24UBPD1102R	Elementary English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester I	5	24UBEC1101R	Extra-curricular	Co and extra- Curricular	0	0	0	4	0	0	1	0	0	100	100
	DSC Minor (Sub-disciplinary) (Any two to be selected)														
	6	24FSCH1104R	Chemistry- I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	7	24FSPH1105R	Physics-I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	8	24FSBO1106R	Biology- I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
		To	tal		14	0	10		0	0	20	200	300	500	1000
	S.	Course Code	Course Title	Course	_	Eng						Maximum Marks for			
	N.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSFS1201R	Forensic Physics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSFS1202R	Fingerprints & other impressions	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24BSFS1203R	Forensic Engineering	MDC	1	0	0	0	0	0	1	40	60	0	100
	4	24BAPS1206R	Psychology of Happiness	MDC	2	0	0	0	0	0	2	40	60	0	100
=	5	24UBPD1202R	Implicit English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester II	6	24UBES1201R	Environmental Education (Online)	VAC	2	0	0	0	0	0	2	40	60	0	100
Sei	7	24UCDT1201R	Ideation and Design Thinking	SEC	1	0	0	0	0	0	1	40	60	0	100
	8	24UBEC1201R	Extra-Curricular	Co and extra- Curricular	0	0	0	4	0	0	1	0	0	100	100
			DSC Minor (S	Sub-disciplina	ary)	(A	ny	two	to	be	select	ed)			
	9	24FSCH1203R	Chemistry- II	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	10	24FSPH1204R	Physics- II	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	11	24FSBO1205R	Biology- II	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
		To	tal		16	0	8	4	0	0	21	320	480	400	1200

				Course		Eng	วลุฮ	em	ent			Maxim	num Mar	ks for	
	S. N	. Course Code	Course Title	Category	L	T	P	S	R	0	С	IA*	SEE*	PE*	Total
	1.	24BSFS2101R	Forensic Ballistics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSFS2102R	Instrumental	DSC Major	3	0	2	0	0	0	4	40	60	100	200
•	3		Agriculture Course	MDC	2	0	0	0	0	0	2	40	60	0	100
FIII.	4	24UBPD2102R	English Language for excellence	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester III	5	24BSFS2104R	Techno Professional Course	SEC	0	0	4	0	0	0	2	0	0	100	100
Š	6	24BSFS2105R	Field Training	Field Training	0	0	0	4	0	0	1	0	0	100	100
			DSC Minor (S		ry)	(Ar	ıy t	wo	to 1	be s	electe	d)			
	7	24FSCH2106R	,	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	8	24FSPH2107R	Physics- III	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	9	24FSBO2108R	Biology- III	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
		То	tal		12	0	16	4	0	0	21	200	300	700	1200
	S.	Course Code	Course Title	Course		_			ent				num Mar		
	No.	Course cour		Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSFS2201R	Forensic Anthropology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSFS2202R	Questioned Document Examination	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24BSFS2203R	Forensic Chemistry	DSC Major	3	0	2	0	0	0	4	40	60	100	200
r IV	4	24BSFS2204R	Cyber & digital Forensics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester IV	5	24UBPD2202R	employability	AEC	0	0	4	0	0	0	2	0	0	100	100
Š	6		Aptitude course	SEC	0	0	0	8	0	0	2	0	0	100	100
	7	24UUFL2201R		MDC	1	0	0	0	0	0	1	40	60	0	100
	8	24UULS2202R		VAC	1	0	0	0	0	0	1	40	60	0	100
	9		UHV	VAC	1	0					1	40	60	0	100
			DSC Minor (S			-	-	_							
	10	24FSCH2205R	,	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	11	24FSPH2206R	,	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	12	24FSBO2207R		DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	-	To	tal		19	0	16		0	0	29	360	540	800	1700
	S.	Course Code	Course Title	Course					ent		-		num Mar		
	N.	24DCEC2101D	r : m : 1	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
			Forensic Toxicology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSFS3102R	Forensic Medicine	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24BSFS3103R	Forensic Biology & Serology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester V	4		Logical Reasoning Course	SEC	0	0	4	0	0	0	2	0	0	100	100
3me			Forensic Photography	SEC	0	0	4	0	0	0	2	0	0	100	100
Š		24BSFS3105R	Summer Internship	DC/PC	0	0	0	0	0	32	4	0	0	100	100
	7	24BSFS3106R	Research Project- I	DC/PC	0	0	0	0	12	0	2	0	0	100	100
	0 1	AEGGHALOEE	DSC Minor (S				-	_	_		electe		60	100	200
		24FSCH3107R	Chemistry- V	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
		24FSPH3108R	Physics- V	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	10 2	24FSBO3109R To	Biology- V tal	DSC Minor	2 13	0 0	2 18	0 0	0 12	0 32	3 28	40 200	60 300	100 900	200 1400

	S. N.	Course Code	Course Title	Course		Enş	gag	em	ent			Maxim	um Mar	ks for	
	S. IV.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
		24BSFS3201R	Forensic Case												
	1		management and	DSC Major	3	0	0	0	0	0	3	40	60	0	100
			expert witness												
V	2	24BSFS3202R	Forensic Audio and	DSC Major	3	0	2	0	0	0	4	40	60	100	200
ter		24D3F33202K	video analysis	DSC Major	ر	U		U	U	U	7	70	00	100	200
Semester	3	24BSFS3203R	DNA Forensic	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Ser	4	24BSFS3204R	Research Project- II	DC/PC	0	0	0	0	24	0	4	0	0	100	100
	DSC Minor (Sub-disciplinary) (Any two to be selected)														
	5	24FSCH3205R	Chemistry- VI	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	6	24FSPH3206R	Physics- VI	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	7	24FSBO3207R	Biology- VI	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	Total				13	0	8	0	24	0	21	200	300	500	1000

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

SEMESTER – I													
Course T	ìtle		Fundamentals of Fo	rensic s	cienc	e & C	rin	ninolo	gy				
Course c	ode	24BSFS111R	Total credits: 4	L	T]	P	S	R		O/F	C	
			Total hours: 45T+301	P 3	0) [2	0	0		0	4	
Pre-requi	isite	Nil	Co-requisite					Nil	•	·			
Program	me		Bachelor of Sci	ence in	Fore	nsic S	cie	nce					
Semeste	er		Fall/ I semester of first year of the programme										
Course	e	1. Understand the definition, history, and scope of forensic science.											
Objectiv	ves	2. Learn the basic principles, tools, and techniques used in forensic science.											
		3. Comprehend the elements, characteristics, and causes of crime, and identify											
			pes of criminal behav		_		_		_			_	
		_	iminological theories	and un	derst	tand t	he	goals	and	obj	jective	es of	
		criminolog	•							1.			
			e with various crime	ınvest	igati	on ag	eno	cies i	n In	dıa	and	their	
001		functions.		-1 f f				1 1	1:	.41. ·			
CO1			y, scope and fundamenta ensic principles, lab hier								S.		
		•	* *								implia	otions	
CO3		_	ne elements, deviant br practical aspects in rea					anu	sociel	lai l	шрис	auons	
CO4		•	* *					inal r	rofili	na	and m	edia's	
004			Discuss various crime theories, investigative techniques, criminal profiling, and media's impact on criminal cases along with the practical aspects.										
CO5		•	s crime investigating	_			es.	and	contri	ibuti	ions t	o the	
		criminal justice		agemeres	,	/II 101	C D,	una	Comm	lout	ions t	o the	
Unit-		ū	ntent	Conta	ct	Le	arn	ing O	utcoi	me		KL	
No.				Hou	r			C					
							staı	nding	histor	y,			
	Fore	ensic science, Sc	ope of Forensic			scope,	etł	nics, p	rincip	oles			
			rensic Science, Basic										
I		-	ic Science, Tools and	8								1,2	
		•	sic Science, Tasks										
	_	•	sic scientists. Code of										
		es for forensic so											
		•	ic science: Law of			Grasp			princi	iples	s,		
		• • •	ole of exchange, law			lab hi	erar	chy.					
11	_	-	ange, principle of	_								1.0	
II			le of analysis, law of	7								1,2	
	_	oratory, Hierarcl	f Forensic Science										
		ensic Science La	•										
			stics, causes and			Explo	re c	rime	eleme	nts			
			viant behaviour. Hate			devia				1110,			
			rime. Public disorder.			+ 1ul	0	-114 11					
		-	workplace violence.										
III			Juvenile delinquency.	10								1,2	
			rime. Psychological									,	
		-	ality. Situation crime										
		ention. Theories	-										
	_	aviour.											
<u> </u>	L										ı		

IV	Goals and objectives of criminology. Theories of crime: Classical, Positivist, Sociological, Criminal Anthropological. Understanding Modus Operandi. Investigative Techniques. Criminal Profiling. Role of media.	10	Study crime theories, investigating techniques	1,2
V	Crime Investigation Agencies: CFSL, SFSL, GEQD, CBI, NIA, NDTL, IB, BPRnD, CDTS, NCRB.	10	Familiarize with key investigation agencies	1,2
Practical	 To study the history of crime cases from standpoint of forensic science. To compile reports on various types of criminal cases. To evaluate the organizational structure of several forensic science organizations and make suggestions for improvement. To compare the standards of conduct established by various organizations for forensic scientists. To examine criminal cases and clarify which hypothesis best explains the accused's illegal behavior To study at criminal situations where criminal profiling helped the police catch the suspect. To evaluate victimology in a heinous crime. To analyze an instance of juvenile misbehavior and recommend corrective action 	30		1,2,3,4

T1: Encyclopedia of Forensic Science by J.A. Saigel, Elsevier.

T2: Encyclopedia of crime, criminology by Casper davis, koros.

T3: Introduction to Forensic Science by Uttam K.S., Jnanada.

REFERENCE BOOKS:

R1: B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi.

R2: B. S. Nabar, Forensic Science in Crime Investigation, 3rd Edition, Asia Law House.

R3: B. R. Sharma, Forensic Science in Criminal Investigation and Trials, 4th Edition, Universal Law Publishing - An imprint of LexisNexis.

R4: R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey.

R5: Barak, Gregg: Integrative Criminology.

R6: Adler, Freda: Criminology.

R7: Reid S.T.: Crime and Criminology

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped ProgramOutcome						
1	Describe history, scope and fundamentals of forensic science, including ethics.	1,6						
2	Explain the forensic principles, lab hierarchy, and utilizing forensic tools.	1, 2, 6						
3	Recognize crime elements, deviant behavior, hate crimes, and societal implications along with their practical aspects in real life criminal cases	1, 5, 9						
4	Discuss various crime theories, investigative techniques, criminal profiling, and media's impact on criminal cases along with the practical aspects.	1,6						
5	Explain India's crime investigating agencies, their roles, and contributions to the criminal justice system.	1						

chain of custody for crime exhibits along with their practical aspects.				SEMESTER										
Pre-requisite Nil Co-requisite Nil Nil Co-requisite Nil Nil Nil Nil Nil Co-requisite Nil	Course Ti	itle		Crime Sce	ne Ma	nag	ement							
Pre-requisite Nil Co-requisite Bachelor of Science in Forensic Science	Course co	de	24BSFS112R	Total credits: 4	L	T	P	S	R	O/F		С		
Programme Bachelor of Science in Forensic Science				Total hours: 45T+30P	3	0	2	0	0	0	- 4	4		
Semester Fall/ I semester of first year of the programme	Pre-requi	site	Nil	Co-requisite			•	Nil		•				
1. Comprehend crime scene definition, importance, management, and reasons for crimes in India. 2. Recognize various crime scene types and roles of police, experts, and judicial officers. 3. Learn barricading, photography, sketching, and search techniques for indoor an outdoor crime scenes. 4. Understand types, collection, preservation, and chain of custody for physical evidence. 5. Grasp principles and stages of crime scene reconstruction, from data collection theory formulation. CO1	Programm	ne		Bachelor of Scien	nce in l	Fore	ensic Scie	ence						
Cost Cost	Semester			Fall/ I semester of fir	rst yea	r of	the prog	ramme	!					
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Indoor, Outdoor. Role of different agencies involved in crime scene management: Police, Medico legal experts, Judicial officers. Barricading of crime scene; Documenting crime scene: Crime scene photography and videography, Crime scene notes. Crime scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns - Strip method, grid method, zone/quadrant types, roles. Master crime scene documentation techniques														
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Barricading of crime scene; Documenting crime scene: Crime scene photography and videography, Crime scene notes. Crime scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns – Strip method, grid method, zone/quadrant Master crime scene documentation techniques 10	II			•	7						1,2			
Barricading of crime scene; Documenting crime scene: Crime scene photography and videography, Crime scene notes. Crime scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns – Strip method, grid method, zone/quadrant Master crime scene documentation techniques				experts, Judicial										
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videography, Crime scene notes. Crime scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns – Strip method, grid method, zone/quadrant			-	_					ene					
scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns - Strip method, grid method, zone/quadrant														
triangulation method, baseline method, polar coordinate method. Search: definition, objectives, search patterns - Strip method, grid method, zone/quadrant							teeming	ues						
coordinate method. Search: definition, objectives, search patterns - Strip method, grid method, zone/quadrant			_											
Search: definition, objectives, search patterns – Strip method, grid method, zone/quadrant	III		-	, ousemire mouneu, potur	10)					1,2	•		
- Strip method, grid method, zone/quadrant				piectives, search patterns										
			_	-										
wheel method.			•	,,										
Definition, types of physical evidences, Understand evidence		Def	inition, types of p	hysical evidences,			Underst	and evic	dence					
IV Collection, packaging, preservation and 10 collection preservation	IV			•	10)	collection	n prese	rvation	ı	1,2			
forwarding of physical evidences, Chain of procedures		forv	varding of physic	al evidences, Chain of			procedu	res						

	custody			
V	Crime scene reconstruction: Introduction, importance, nature and principles: recognition, identification, individualization and reconstruction, stages: data collection, conjecture, hypothesis formulation, testing, theory formation.	10	Acquire principles of crime reconstruction	1,2
Practical	 Securing the crime scene, clothing, and plan for crime scene management. Demonstration of photography of scene of crime and evidences. Searching and Listing of evidences at indoor crime scene. Searching and Listing of evidences at outdoor crime scene. Sketching of Crime scene by triangulation method. Sketching of Crime scene by baseline method. Sketching of Crime scene by Polar coordinate method. Evidence collection, preservation, packaging, sealing and labeling of physical evidences. Evidence collection, preservation, packaging, sealing and labeling of biological evidences. Demonstration of reconstruction of scene of crime 	30	Describe, illustrate and explain and apply staining techniques and carry out microscopic examination.	1,2,3,4

T1: Saferstein R., Criminalistics, Prentice Hall Inc. USA.

REFERENCE BOOKS:

- R1: Gilbert N. (3rd Edition), Criminal Investigation, Macmillan Publishing company.
- R2: Nicharrs J., Investigative Forensic Hyponsis. CRC Press LLC.
- R3: Sharma B.R., Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Recognize crime scene investigation, and understand the reasons for crime along with their practical aspects.	1, 2, 6
2	Explain different crime scene types and comprehend the role of investigating agencies in crime scene management along with their practical aspects.	1, 2, 3
3	Apply techniques for documenting crime scenes, utilizing various search patterns along with their practical aspects	1, 2, 3, 7
4	Describe the methods for collecting evidences, package, and preserve, and maintain the chain of custody for crime exhibits along with their practical aspects.	1, 2, 6, 7, 8
5	Analyze crime scene reconstruction using various principles of data collection, hypothesis formulation, testing, and theory formation.	1, 2, 3

		SEMEST	ER – I									
Course Ti	itle	(Criminal L	aw								
Course co	ode 24BSFS113R	Total credits: 3		L	T	P	S	R	O/F	C		
		Total hours: 30T-		2	0	2	0	0	0	3		
Pre-requi		Co-requisi					Nil					
Programm	ne	Bachelor of S										
Semester		Fall/ I semester of first year of the programme										
Course	_	1. Grasp offence forms, case classification, legislation components, judicial hierarchy.										
Objective		cognizable and nor	n-cognizabl	e off	ences	, bail	lable	and r	ion-bai	lable		
	offences.	. 1 . 1										
	I	ions related to offen	-	ındıvı	iduals	and	prope	rty.				
	_	itutional articles and	-	. •								
CO1		cific legal areas and a			1:.4:		1:.	.:1	.1	1		
CO1		and their forms, ong with their practic	•			_	11 C1V	ıı an	iu crin	mnai		
CO2		es against persons					CAVIIO	1 offe	ncec 1	ındər		
(02		along with their practices		•		_	ъслиа	1 0116	115C5 L	muci		
CO3							no th	e exa	minatic	on of		
	11.	Apply knowledge of evidence and rules of relevancy, including the examination of witnesses and expert testimony.										
CO4		Demonstrate an understanding of constitutional articles and acts, such as the Narcotic										
		Drugs and Psychotropic Substances Act along with their practical aspects in real cases.										
CO5		acts, including the										
	Prohibition Act,	Prohibition Act, and Wildlife Protection Act along with their practical aspects in real										
	cases.											
Unit-	Conte	ent	Contact		Lear	ning	Outc	ome		KL		
No.			Hour									
	Definition and forms							nderst	and			
	classification: civil a			case	class	ificat	ion					
	fundamental compon											
	legislation. Constituti	ion and judicial										
	system hierarchy.											
I	Cognizable and non-counder the Criminal	•	5							1,2		
	Bailable and non-b											
	under the Criminal											
	Bailable and non-bail											
	well as other pertine											
	291 through 293.											
	Offences against perso	n- Sections, 299,		Dist	ingui	sh and	d anal	yze				
	300, 302, 304, 304A, 3				ific o			-				
	319, 320, 325, 359, 36	2, 363. Section										
II	375 & 376 and their ar	nendments.	7							1,2		
	Offences against prope	erty- Sections 378,										
1	•		•									
	383, 390, 391, 395, 41	5, 420, 441, 463,										

III	Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses. Examination in chief. Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.	8	Grasp evidence rules, witness examination	1,2
IV	Articles 20, 21, 22, 51A of Indian Constitution, Narcotic Drugs and Psychotropic Substances Act. Drugs and Cosmetics Act, Prevention of Corruption	5	Understand constitutional articles, rights	1,2
V	Explosive Substances Act. Arms Act. Dowry Prohibition Act. Act. Wildlife Protection Act. I.T. Act. Environment Protection Act	5	Explore specialized legal acts	1,2
Practical	 To prepare a schedule of five cognizable and non-cognizable crimes. To study crime scene in which accused was punished under charges of section 302. To study crime scene in which accused was punished under charges of section 375. To cite a case under section 14 of the constitution of India where Right to equality before law was allegedly violated. To study a case in which Drugs and cosmetic act was invoked. To study a case in which arms act was invoked 	30		1,2,3,

T1: Constitution of India, Bare Act.

REFERENCE BOOKS:

R1: D.A. Bronstein, Law for the Expert Witness, CRC Press, Boca Raton.

R2: Vipa P. Sarthi, Law of Evidence, 6th Edition, Eastern Book Co., Lucknow.

R3: A.S. Pillia, Criminal Law, 6th Edition, N.M. Tripathi Pvt Ltd., Mumbai.

R4: R.C. Nigam, Law of Crimes in India, Volume I, Asia Publishing House, New Delhi.

R5: M. Monir, Law of Evidence, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Define offenses and their forms, compare and distinguish civil and criminal classifications along with their practical aspects in real cases.	1
2	Interpret offenses against persons and property, including sexual offenses under relevant sections along with their practical aspects in real cases.	1
3	Apply knowledge of evidence and rules of relevancy, including the examination of witnesses and expert testimony	1
4	Demonstrate an understanding of constitutional articles and acts, such as the Narcotic Drugs and Psychotropic Substances Act along with their practical aspects in real cases.	1, 2, 5
5	Interpret various acts, including the Explosive Substances Act, Arms Act, Dowry Prohibition Act, and Wildlife Protection Act along with their practical aspects in real cases.	1,2,5

				STER – I								
Course	Title			lementary	English							
Course	code	24UBPD112R	Total credits: 2			P	S	R	O/F	C		
			Total hours: 60		0	4	0	0	0	2		
Pre-req		Nil	Co-requisi				Nil					
Prograi			Bachelor o									
Semeste	er		Fall/I Semeste									
Course		1.To enable stude	•	•	•	, article	s, auxi	liary ve	rbs, an	d		
Objecti	ves	construct affirmative and negative sentences.										
		2. To master advar						rminers	s, const	ruct		
		various types of	sentences, and u	nderstand d	legrees of	compa	rison.					
		3. To develop spea	aking skills: Enab	le students	to introdu	ice ther	nselve	s, use co	orrect			
		pronunciation, i	ntonation, and str	ess, and ef	fectively a	ısk and	offer i	nforma	tion.			
CC)1	Equip students to 1	recognize and app	oly parts of	speech, a	rticles,	and au	xiliary	verbs, a	and		
		to create both affir	mative and negat	ive sentenc	es.							
CO)2	Teach students to a	apply determiners	s, form diff	erent type	s of ser	ntences	s, and co	mpreh	end		
		degrees of compar	rison.									
CO)3	Prepare students to	confidently intro	oduce them	selves, us	e prope	r pron	unciatio	n,			
		intonation, and stre	ess, and effective	ly ask for a	nd provid	e infori	nation					
CO)4	Help students grasp the communication process, differentiate between communication										
		types, manage both formal and informal communication, and identify barriers to										
		effective communi	ication.									
CO)5	Teach students the	key components	of an effec	tive prese	ntation	and he	ow to us	se visua	al		
		aids proficiently.										
Unit-		Content		Contact	Le	arning	Outco	me	K	L		
NT.		content		**		··· · · · · · · · · · · · · · · · · ·	O acce	,,,,,				
No.				Hour								
NO.	1	s of Grammar (Fli	pped	Hour	Student	s will c						
No.	classr	room)	pped	Hour	Student	s will d	ndersta		of			
	classr i. Par	rts of Speech	pped		Student	s will d	ndersta			2.3		
I I	i. Par	room) rts of Speech ticles	pped	Hour 6	Student	s will d	ndersta			2, 3		
	i. Par ii. Ar iii. Au	room) rts of Speech ticles axiliary Verbs			Student	s will d	ndersta			2, 3		
	i. Par ii. Ar iii. Au iv. Af	room) rts of Speech ticles exiliary Verbs firmative and Nega	tive Sentences		Student fundam gramma	s will c ental u ar rules	ndersta	anding (2, 3		
	i. Par ii. Ar iii. Au iv. Af Gran	rts of Speech ticles xiliary Verbs firmative and Nega amar (Flipped clas	tive Sentences		Student fundam gramma	s will dental unar rules	ndersta constru	et		2, 3		
	i. Par ii. Ar iii. Au iv. Af Gran i. De	rts of Speech ticles exiliary Verbs firmative and Negar terminers	tive Sentences sroom)		Student fundam gramma Student gramma	s will contain under rules	ndersta	et and		2, 3		
I	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped clast terminers entence Construction	tive Sentences sroom)	6	Student fundam gramma	s will contain under rules	ndersta	et and	1,2			
	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped clast terminers entence Construction pes of Sentences (A)	tive Sentences sroom)		Student fundam gramma Student gramma	s will contain under rules	ndersta	et and	1,2	2, 3		
I	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped clast terminers entence Construction pes of Sentences (A	tive Sentences sroom) a Assertive,	6	Student fundam gramma Student gramma	s will contain under rules	ndersta	et and	1,2			
I	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty Im iv. De	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped clas terminers ntence Construction pes of Sentences (A perative, etc.) gree of Comparisor	tive Sentences sroom) a Assertive,	6	Student fundam gramma Student gramma varied s	s will cental unar rules	onstru correc e types	et et and	1,2			
I	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty Im iv. De	rts of Speech ticles txiliary Verbs firmative and Negar mar (Flipped clast terminers ntence Construction pes of Sentences (Aperative, etc.) gree of Comparisor king Skills	tive Sentences sroom) a Assertive,	6	Student fundam gramma Student gramma varied s	s will contain under rules s will contain under rules s will contically sentences will contain under rules will under rules will contain under rules will under rule under rules will under rules will under rules will under rule under ru	onstru correce types	et and	1,2			
I	i. Parii. Ariii. Au iv. Af Gram i. De ii. Ser iii. Ty Im iv. De Speal i. Int	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped clast terminers entence Construction pes of Sentences (Aperative, etc.) gree of Comparisor king Skills roduction and Gree	tive Sentences sroom) n Assertive, n tings	6	Student gramma Student gramma varied s Student introductions	s will central unar rules s will centrally sentences will consider the sentences will be sentences will consider the sentences will consider the sentences will be sentences will	onstru correce types	et et and s.	1,2,	, 3,4		
I	i. Parii. Arriii. Auriv. Aff Gram i. De ii. Seriii. Ty Im iv. De Speal i. Int ii. Pro	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers ntence Construction pes of Sentences (A perative, etc.) gree of Comparison king Skills roduction and Gree bounciation, Intonat	tive Sentences sroom) assertive, tings tion, Stress	6	Student gramma varied s Student introducengage	s will central under rules will contically sentences will contically sentences will contically sentences will contically sentences will continue them in basic	construction corrected types confiderately converse conve	et et and s.	1,2,			
I	i. Pai ii. Ar iii. Au iv. Af Gran i. De ii. Ser iii. Ty Im iv. De Speal i. Int ii. Pro iii. As	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers entence Construction pes of Sentences (Apperative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering in	tive Sentences sroom) assertive, tings tion, Stress	6	Student gramma varied s Student introducengage with co	s will central unar rules s will centrally sentences s will centrally sentences will centrally sentences them in basic prect pr	constru correce e types confide aselves c conve	ently and ersation.	1,2,	, 3,4		
I	i. Parii. Ariii. Au iv. Af Gram i. De ii. Seriii. Ty Im iv. De Speal i. Int ii. Pro iii. As Comi	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers ntence Construction pes of Sentences (A perative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering in munication Skills	tive Sentences sroom) Assertive, tings tion, Stress nformation	6	Student fundam gramma Student gramma varied s Student introducengage with co	s will cental urar rules s will centically sentences will centences will center them in basic rrect pres will e	constru correce e types confide aselves e conve onunci	ently and ersation.	1,2, s 1,2,	, 3,4		
I	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty Im iv. De Speal i. Int ii. Pro iii. As Comm i. Int	rts of Speech ticles txiliary Verbs firmative and Negar mar (Flipped clas terminers ntence Construction pes of Sentences (A perative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering in nunication Skills roduction to Comm	tive Sentences sroom) Assertive, tings tion, Stress aformation	6	Student gramma varied s Student introducengage with co	s will cental unar rules s will catically sentences will cate them in basic rrect pros will en incate incate in s will en	construction confiders as elves as converted converted to the converted converted converted to the converted converted converted to the converted converted converted converted to the converted conver	ently and ersation rely formal	1,2, s 1,2,	, 3,4		
II	i. Par ii. Ar iii. Au iv. Af Gram i. De ii. Ser iii. Ty Im iv. De Speal i. Int ii. Pro iii. As Comm i. Int	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers intence Construction pes of Sentences (Apperative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering in munication Skills roduction to Comm occess and Types of	tive Sentences sroom) Assertive, tings tion, Stress nformation unication Communication,	6 5	Student fundam gramma Student gramma varied s Student introducengage with co	s will cental unar rules s will catically sentences will cate them in basic rrect pros will en incate incate in s will en	construction confiders as elves as converted c	ently and ersation rely formal	1,2, 1,2, s 1,2	2, 3		
I	i. Parii. Arriii. Audiv. Aff Gram i. Defii. Seriii. Ty Im iv. Def Speal i. Int ii. Profiii. As Commain. For	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering ir munication Skills roduction to Comm ocess and Types of ormal and informal of	tive Sentences sroom) Assertive, tings tion, Stress nformation communication, communication,	6	Student gramma varied s Student introducengage with co	s will cental unar rules s will catically sentences will cate them in basic rrect pros will en incate incate in s will en	construction confiders as elves as converted c	ently and ersation rely formal	1,2, 1,2, s 1,2	, 3,4		
II	i. Pariii. Ariii. Au iv. Af Gram i. De ii. Seriii. Ty Im iv. De Speal i. Int ii. Pro iii. As Comi i. Int ii. Pro iii. For iii. For	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers intence Construction pes of Sentences (Apperative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering in munication Skills roduction to Comm ocess and Types of commal and informal conderstanding Barrier	tive Sentences sroom) Assertive, tings tion, Stress nformation communication, communication,	6 5	Student gramma varied s Student introducengage with co	s will cental unar rules s will catically sentences will cate them in basic rrect pros will en incate incate in s will en	construction confiders as elves as converted c	ently and ersation rely formal	1,2, 1,2, s 1,2	2, 3		
II	i. Pariii. Ariii. Au iv. Af Gram i. De ii. Seriii. Ty Im iv. De Speal i. Int ii. Pro iii. As Comi i. Int ii. Pro iii. For iii. For	rts of Speech ticles exiliary Verbs firmative and Negar mar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparisor king Skills roduction and Gree onunciation, Intonat king and offering ir munication Skills roduction to Comm ocess and Types of ormal and informal of	tive Sentences sroom) Assertive, tings tion, Stress nformation communication, communication,	6 5	Student gramma varied s Student introducengage with co	s will cental unar rules s will catically sentences will cate them in basic rrect pros will en incate incate in s will en	construction confiders as elves as converted c	ently and ersation rely formal	1,2, 1,2, s 1,2	2, 3		

	Presentation Skills		Students will deliver well-	
	i. Introduction		organized and visually	
V	ii. Essential characteristics of a good	8	supported presentations.	1,2
	presentation			
	iii. Use of Visual Aids in Presentation			

- T1: Chaturvedi, P.D., Chaturvedi Mukesh, 2011.Business Communication: Concepts, Cases and Applications, second edition, Pearson, Noida.
- T2: Alex K., Chand, S, 2009. Soft Skills: Know Yourself and Know the World, first edition, S. Chand & Company Ltd.: New Delhi.

REFERENCE BOOKS:

- R1:Quirk, Randolph. (2010) A Comprehensive Grammar of the English Language Randolph Quirk, Sidney Greenbaum, Pearson Education India.
- R2:Marks, Jonathan. (2017) IELTS Advantage Speaking and Listening Skills: A step-by- step guide to a high IELTS speaking and listening score. Book + CD-ROM, Delta Publishing by Kle.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Equip students to recognize and apply parts of speech, articles, and auxiliary verbs, and to create both affirmative and negative sentences.	5, 7, 9
2	Teach students to apply determiners, form different types of sentences, and comprehend degrees of comparison.	5, 7, 9
3	Prepare students to confidently introduce themselves, use proper pronunciation, intonation, and stress, and effectively ask for and provide information.	5, 7, 9
4	Help students grasp the communication process, differentiate between communication types, manage both formal and informal communication, and identify barriers to effective communication.	5, 7, 9
5	Teach students the key components of an effective presentation and how to use visual aids proficiently.	5, 7, 9

			SEMESTE	R – I							
Course Ti	itle		Ch	emistr	y - 1						
Course co	de	24FSCH114R	Total credits: 2	L	T	P	S	R	O/F	C	
			Total hours: 30T	2	0	0	0	0	0	2	
Pre-requi		Nil	Co-requisite				Ni	il			
Programm	ne		Bachelor of Scio								
Semester			Fall/ 1 nd semester of								
Course Objectiv		including van displacements i 2. Explore isomer conformational associated with 3. Grasp the kinet van der Waals 64. Comprehend theory, wave atoms. 5. Study periodic radii, ionization	principles of hybridized der Waals interest novalent bonds. ism concepts, includitisomerism, and was different isomers. ic molecular theory of equation, as well as the quantum mechanics nechanics, quantum properties of element nenthalpy, electron goint the periodic table.	ng options, and of gases the principal aspectal aspectal aspects, focu	hyd cal iso and the deviation, de	omerisment no notations atomic atomic defects on effects	bond m, geometric from icang the e structive received	metric ature deal be liquef ture, i	isomeris, and proceed and procedure of including configurate charge,	m, and perties and the gases. Bohr's ion of	
CO1		Understand the hybridization of carbon, types of bonds, electronic effects, and the shapes of molecules. Identify the kinetic molecular theory of gases, deviations from ideal behavior, and									
CO2		properties of enantiomers.									
CO3		Explain Bohr's theory, wave mechanics, and quantum numbers.									
CO4		Understand the periodic properties of elements, including effective nuclear charge and									
		ionization enthalpy. Describe electron gain enthalpy, trends in electronegativity, and the variation of									
CO5		electronegativity v		ido III	Ciccii	onegai	ivity,	and ti	iic variat	1011 01	
Unit-		Conte		Conta	act	Le	arnin	g Outo	come	KL	
No.				Hou			•	5			
I	of n ang delo inte acid dipo bon elec Nuc disp (ind reso hyp read inte free	pridization of carbon nolecules, bond leng les, bond energy, lo ocalized chemical be ractions, hydrogen la de bases, their rela- ble moment. Homol de breaking. Types of the trophiles and nuclear eleophilicity basic blacements in a coval ductive effect, electronance effect or mes- erconjugation). Type tions & their mecha- redicals, carbenes, es, shapes & relative	gths and bond calized and ond, van der Waals conding. Organic ative strengths, ytic and heterolytic of reagents- ophiles. ity. Electronic alent bond comeric effect, comeric effect, res of organic anisms. Reactive ons, carbanions, and nitrenes (their	7		Under hybrid bonds	lizatio	_		1,2	

	Concept of isomerism, Types of		Grasp isomerism concepts,	
	isomerism, Optical isomerism - elements		stereochemical	
	of symmetry, molecular chirality,		nomenclature.	
	enantiomers, stereogenic center, optical			
	activity, specific rotation, properties of			
	enantiomers, Chiral and achiral molecules			
	with two stereogenic centers,			
	diastereomers, threo and erythro			
	diastereomers, meso compounds,			
	resolution of enatiomers, inversion,			
	retention and racemization. Relative and			
	absolute configuration, sequence rules, D			
II	& L and R & S systems of nomenclature.	_		1,2
	Geometric isomerism - determination of	5		
	configuration of geometric isomers.Syn-			
	anti & E & Z notations with C.I.P. rules,			
	Conformational isomerism -			
	conformational analysis of ethane and n-			
	butane; conformations of cyclohexane,			
	axial and equatorial bonds, conformation			
	of mono substituted cyclohexane			
	derivatives, Fischer and flying wedge			
	formulae Newman projection and			
	Sawhorse formulae & their			
	interconversion.			
	The kinetic molecular theory of gases,		Master kinetic theory, real	
	deviation from ideal behaviour, van der		gas properties	
	Waals equation of states, kinetic energy &		See brokerner	
	temperature, Maxwell distribution of			
	molecular velocities & energies, types of			
	molecular velocities, collision parameters			
III	(diameter, cross section, number	8		1,2
	frequency), mean free path, the vander	Ü		
	Waal's equation of critical state, principal			
	of corresponding states, reduced equation			
	of state, molar masses & density of real			
	gases, liquefaction of gases.			
	Bohr's theory, its limitations and atomic	1	Comprehend atomic	
	spectrum of hydrogen atom. Wave		spectra, wave mechanics	
	mechanics:de Broglie equation,			
	Heisenberg's Uncertainty Principle and its			
	significance, Schrödinger's wave			
	equation, significance of ψ and ψ. Radial			
IV	and angular wave functions for hydrogen	5		1,2
	atom. Quantum numbers and their			
	significance. Probability diagrams of s and			
	p orbitals. Pauli's Exclusion Principle,			
	Hund's rule of maximum multiplicity,			
	Aufbau's principle and its limitations.			
	Detailed discussion of the following		Learn periodic properties,	
V	periodic properties of the elements, with	5	electronegativity trend	1,2
	r proposition of the elements, with	J		

reference to s & p-block. Effective nuclear	
charge, shielding or screening effect,	
variation of effective nuclear charge in	
periodic table. Atomic radii (van der	
Waals). Ionic and crystal radii. Covalent	
radii. Ionization enthalpy, Successive	
ionization enthalpies and factors affecting	
ionization energy. Applications of	
ionization enthalpy. Electron gain	
enthalpy, trends of electron gain enthalpy.	
Electronegativity, Variation of	
electronegativity with bond order,	
hybridization, group electronegativity	

T1: Inorganic Chemistry, J. D. Lee. Concise, 5th Edition, Oxford.

REFERENCE BOOKS:

- R1: Organic Chemsitry, Paula Yurkanis Bruice, 8th Edition, Pearson.
 R2: Organic Chemsitry, Jonathan Clayden, Nick Greeves and Stuart Warren, 2nd Edition (South Asia Edition), Oxford.
- R3: Stereochemistry of Organic Compounds Principles and Applications, D. Nasipuri, 4th Edition, New Age International Publishers
- R4: Physical Chemistry, Gurdeep Rai, Krishna Prakashan Media (P) Ltd. R5: Physical Chemistry, Puri Sharma Pathania, Vishal Publishing Co.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Understand the hybridization of carbon, types of bonds, electronic effects, and the shapes of molecules.	1				
2	Identify the kinetic molecular theory of gases, deviations from ideal behavior, and properties of enantiomers.	1				
3	Explain Bohr's theory, wave mechanics, and quantum numbers	1				
4	Understand the periodic properties of elements, including effective nuclear charge and ionization enthalpy.	1, 8				
5	Describe electron gain enthalpy, trends in electronegativity, and the variation of electronegativity with bond order.	1				

			SEMESTE	R – I							
Course Title Physics - 1											
Course	code	24FSPH115R	Total credits: 2	L	T	P	S	R	O/F		С
			Total hours: 30T	2	0	0	0	0	0		2
Pre-req	uisite	Nil	Co-requisite			•	N	il			
Program	nme	Bachelor of Science in Forensic Science									
Semeste	r		Fall/ 1 nd semester o								
Course		1. Understand scalar and vector quantities, their properties, and interpretations,									
Objectiv	ves	including scalar and vector products.									
		2. Explore coordinate systems, motion concepts, frames of reference, and principles of									
		relativity.									
		3. Analyze fluid dynamics, elastic properties of matter, and equations like Bernoulli's									
		l	and continuity.4. Grasp energy principles, work, conservation, rotational dynamics, and relationships								
			_	ervation,	rota	ational	dynan	ncs, a	nd relati	ons	hips
			nd angular variables.	, •	1	1		1			1
			5. Differentiate wave types, calculate properties, delve into sound waves, and explore								
CO	1	ultrasonic applic		ن مممسان	mata	ar rat and	المالية	242242	اسىدە	on d	l tha
	1		Understand scalar and vector properties, coordinate systems, divergence, curl, and the								
CO)	distinction between conservative and non-conservative forces.									
	L	Identify the concepts of frame of reference, inertial and non-inertial frames, special theory of relativity, Lorentz transformations, and relativistic addition of velocities.									
CO	3	Explain the fundamentals of motion, acceleration, projectile motion, pseudo forces,									
	3	elastic properties of matter, fluid dynamics, and equations like Bernoulli's.									
CO	4	Explain the concepts of energy, kinetic energy, work, rotational variables, and the									
	-	conservation of energy, especially in rotational motion.									
CO	5	Describe different types of waves, sound waves, Doppler effect, sound intensity									
		measurement, and the introduction to ultrasonic waves and their applications.									
Unit-		Conten		Contac						k	ΚL
No.				Hour							
	Scala	r and Vector, Proper	ties of vectors,		N	Aasterii	ng vec	tors an	d		
	scala	and vector product,	scalar and their		c	coordinate systems					
	_	pretation in terms of									
	_	ctively, scalar and ve									
I		epts of Cartesian and	7						1	1,2	
		inate systems, area, volume, velocity, and									
		eration in these syste									
		gence and curl. Cons									
		ervative forces.	1 1 ' ' 1				1 4	,	1		
		rame of reference, Inertial and non-inertial rame, Galilean transformation and				Graspin eferenc	_	•	na		
				ľ	eterenc	e mani	ies.				
		iance, Non-Inertial f eed of light, Postulat									
	_	ry of Relativity, Lore									
II		formations, Length c	5						1	1,2	
		on, Relativistic addit		S							
			ativistic momentum								
	energ	energy, Transformation of momentum and									
	cherg	J.									

Ш	Definition of motion, position and displacement, average velocity, average speed, acceleration, acceleration of freely falling body, projectile motion, Pseudo forces, elastic properties of matter, elastic constants and their interrelations Fluid dynamics, equation of continuity, Bernoulli's equation, stream line and turbulent flow, Poiseuille's equation.	8	Analyzing motion, forces, and fluids.	1,2
IV	Energy, kinetic energy, work, work done by gravitational force, work done by spring force, power, work and potential energy, work done on system by external force, conservation of energy. The rotational variable, rotation with constant angular acceleration, relating linear and angular variables, kinetic energy of rotation.	5	Understanding energy, work, and rotation	1,2
V	Types of waves, transverse and longitudinal waves, wavelength and frequency, speed of travelling wave, the wave equation, sound waves, speed of sound, the Doppler effect. Velocity of sound, noise and sound intensity measurement, echo, Sabine's Formula, Sound distribution in an auditorium, introduction to ultrasonic, production of ultrasonic waves, applications of ultrasonic	5	Exploring waves and sound properties	1,2

T1: Halliday, Resnick and Walker, Fundamentals of Physics, John Wiley & Sons Publication, sixth edition.

REFERENCE BOOKS:

R1: R. K. Gaur and S. L. Gupta, Engineering Physics, DhanpatRai Publication, 8 th Edition,

R2: A.P. French, Vibrations and waves, CBS Publishers and Distributors, Inc., first Indian edition.

R3: Heat and Thermodynamics: Brij Lal and N. Subramanyam

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Understand scalar and vector properties, coordinate systems, divergence, curl, and the distinction between conservative and non-conservative forces.	1					
2	Identify the concepts of frame of reference, inertial and non- inertial frames, special theory of relativity, Lorentz transformations, and relativistic addition of velocities.	1					
3	Explain the fundamentals of motion, acceleration, projectile motion, pseudo forces, elastic properties of matter, fluid dynamics, and equations like Bernoulli's	1					
4	Explain the concepts of energy, kinetic energy, work, rotational variables, and the conservation of energy, especially in rotational motion.	1					
5	Describe different types of waves, sound waves, Doppler effect, sound intensity measurement, and the introduction to ultrasonic waves and their applications.	1					

			SE	MESTER –	I									
Course	Title			Biolo	ogy- 1									
Course	code	24FSBO116R	Total cr	edits: 2		L	T	P	S	R	O/F	C		
			Total ho	ours: 30T		2	0	0	0	0	0	2		
Pre-rec	quisite	Nil		Co-requisite	requisite Nil									
Progra				or of Science										
Semest				d semester of first year of the program										
Course				e understanding of Algae, covering general characteristics,										
Object	ives	classification, reproduction, and economic significance.												
		2. Study the fundamental aspects of fungi, including their characteristics, classification,												
		and economic importance.3. Explore lichens, understanding their general features, structure, reproduction, and												
		economic importar		ing then gen	ciai icai	iurcs,	Sirui	Juic,	, repr	Juuci	ion, am	u		
		4. Gain insights into		tes, covering	characte	eristic	es, ela	assifi	catio	n. ren	roducti	on.		
		and economic relev		, 8			,			, 1		,		
		5. Examine Pteridoph	ytes, foc	using on cha	racterist	ics, c	lassi	ficati	on, re	prod	uction,	and		
		economic importar	nce. Addi	itionally, exp	lore eco	logic	al co	ncep	ts suc	h as e	ecosyste	ems,		
		energy flow, bioge		<u>*</u>										
C	01	Understand the gene			lassifica	ation	, mo	des	of re	prod	uction,	and		
		_	conomic significance of algae. dentify the general features, classification of fungi, and their economic importance.											
CC														
CO	CO3 Understand of the general asp				, reprod	luctio	n, an	d ecc	onom	ic sig	nifican	ce of		
C	<u> </u>		haracteris	etice classific	eation n	node	ofr	enro	Juctic	n an	d econ	omic		
Identify the general characteristics, classification, importance of bryophytes					anon, n	nouc	5 01 1	Сргос	ucuc	711, a11	ia ccom	OHIIC		
CO)5	Identify the concept	*	osystems, th	eir stru	icture	an	d fu	nctio	n, er	nergy 1	flow,		
		biogeochemical cycle									23			
Unit-		Content		Contact		Learning Outcome KL								
No.				Hour										
I	-	General account of Alg	,		Identi	-				nd				
		s of algae. Reproduction		7	reprod			conoi	nic			1,2		
	Ū	Economic importance o	Ū		impor									
II		General account of fu			Classi		-		_	sp				
		of different classes of formic importance fungi.	ungı,		econo	mic i	reieva	ance.						
		EN: General account of	lichen	5								1,2		
		re and reproduction,	nenen,											
		mic importance Lichen.												
III		nytes: General account			Differ	rentia	te cla	asses	, und	erstar	ıd			
		nytes, Study of differen		8	reproc							1.2		
		of Bryophytes, Reprod		O								1,2		
		mic importance bryoph	-											
IV		ophytes: General account			Classi									
		ophytes, Study of differ	ent	_	under		_					1.0		
		of Pteridophytes,		5	ecolog	gıcal	sıgni	tican	ice			1,2		
	_	duction, Economic important	ortance											
	rierido	phytes.												

V	Ecology: Concept of Ecosystem,		Grasp ecosystem concepts, energy	
	Ecosystem structure and function,		flow, succession	
	Energy flow in ecosystem,	5		1,2
	Biogeochemical cycles in ecosystem,			
	Sucession			

T1: Hand Book of Microalgal culture. Ed by A. Richmond. Blackwell Publishing House.

REFERENCE BOOKS:

- R1: Hand Book of Microalgal culture. Ed by A. Richmond. Blackwell Publishing House.
- R2: Algae- Anatomy, Biochemistry and Biotechnology-L. Barsanti& P. Gualtieri. Taylor &Francis.
- R3: Phycology (4th Edition) R.L. Lee, Cambridge University Press. Nasipuri, 4th Edition, New Age International Publishers

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped ProgramOutcome						
1	Understand the general characteristics, classification, modes of reproduction, and economic significance of algae.	1						
2	Identify the general features, classification of fungi, and their economic importance.	1						
3	Understand of the general aspects, structure, reproduction, and economic significance of lichens	1						
4	Identify the general characteristics, classification, modes of reproduction, and economic importance of bryophytes.	1						
5	Identify the concept of ecosystems, their structure and function, energy flow, biogeochemical cycles, and the process of succession.	1						

			SEMES	STER -	- II								
Course T	itle			Foren	sic P	hysics							
Course co	ode	24BSFS121R	Total credits: 4		L	T	P	S	R	O/F	C		
			Total hours: 45T		3	0	2	0	0	0	4		
Pre-requi		Nil	Co-requisite					Nil					
Program			Bachelor o										
Semester			Fall/ II semeste				1 0						
Course Objective	es	marks, skid 2. Identify, claracteristi 3. Examine glassing and conductive chemical and the state of the state	assify, and analyzes, tracing, lifting, as properties, inclutes soil examinationalysis. es of paints, condribution, and perfor	mber restoration, and vehicular accident assessment. alyze tool marks, emphasizing class and individual g, and photographic examination. acluding composition, fractures, and direction of impact, tions based on color, density, size distribution, and conduct microscopic and macroscopic studies, analyze afform pyrolysis gas chromatography. collection, and evaluation, and classify fibers, conducting									
CO1			nalyze various imp						context	of fo	rensic		
CO2		Apply techniques for making casts, and obliteration and restoration methods, showcasing competence in tool mark analysis.											
CO3			Demonstrate expertise in glass and soil analysis, contributing to forensic investigations										
			ehensive examination		•		•			8			
CO4			ency in forensic pa							natchin	g and		
		chemical analys	ses.										
CO5			ompetence in hair a			•		_					
			igations involving	these	types	of phy	sical 6	evidenc	e alon	g with	their		
		practical aspect											
Unit-		Conto	ent	Cont		L	earnir	ig Outo	come		KL		
No.	т			Hou		TT 1 .	1.1	T		C			
I	impr mark	ession evidence: ession evidence, as, serial number cular accident	tyre marks, skid	8		Underst impress accident	ion ma	ırks in v			1,2		
Ш	mark chara mark mark		vidual g and lifting of examination of tool king-cast, methods	7		Elucida their res recordin	storatio	n and r	nethod	of	1,2		
III	Glass: types and their composition. determination of direction of impact, fractures, examination of glass: colour, fluorescence, physical matching, densit comparison, refractive index. Soil: examination of colour, density, size distribution of soil particles, mineral analysis and chemical analysis of soil				10						1,2		
IV		es: types of paint position, forensic	and their examination of	10		Compet		n paints	; 		1,2		

	paints: microscopic and macroscopic			
	studies-pigment distribution, micro-			
	chemical analysis, physical matching,			
	solubility test, pyrolysis gas			
	chromatography			
	Hair: structure of human and animal		Grass fiber, hair morphology,	
	hair. examination of hair, location,		tool marks	
X 7	collection, evaluation;	10		1.2
V	Fibers: classification, microscopic,	10		1,2
	physical and chemical, instrumental			
	examination of fibers.			
	1. To analyze density of glass			
	2. To analyze refractive index of glass			
	3. To analyze density of soil			
	4. To analyze hair			
	5. To analyze types of glass their			
	composition, their macroscopic and			1.0.2
Practical	microscopic properties.	30		1,2,3,
	6. To analyze Hair and fibers, their			4
	composition, their macroscopic and			
	microscopic analysis			
	7. To identify tool marks, their			
	restoration and method of recording			
	those restored marks.			

T1: Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rd Edn) Universal Law Publishing Co. Ltd. New Delhi

REFERENCE BOOKS:

- R1: Morris, E. K., and Braukman,, C. J.(Eds.), Behavioural Approaches to Crime and Delinquency- A Hand book of Application, Research and Concepts, Plennum Press, New York,
- R2: Abaadinsky, H., Organised Crime (2nd Edn.), Nelson Hall, Chicago.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Identify and analyze various impression evidence types in the	1, 2, 3					
1	context of forensic investigations.	1, 2, 3					
	Apply techniques for making casts, and obliteration and						
2	restoration methods, showcasing competence in tool mark	1, 2					
	analysis.						
	Demonstrate expertise in glass and soil analysis, contributing to						
3	forensic investigations through comprehensive examinations	1, 3					
	along with their practical aspects.						
4	Exhibit proficiency in forensic paint examinations, including	1 2					
4	physical matching and chemical analyses.	1,3					
	Demonstrate competence in hair and fiber analysis, providing						
5	valuable contributions to forensic investigations involving	1 2					
3	these types of physical evidence along with their practical	1, 3					
	aspects.						

			SEMESTE	R – II								
Course Ti	itle		Forer	ısic Psy	ycho	logy						
Course co	de	24BSFS122R	Total credits: 3		L	T	P	S	R	O/F	C	
			Total hours: 30T-	+30P	2	0	2	0	0	0	3	
Pre-requi	site	Nil	Co-requisite					Nil				
Programm	ne		Bachelor of Sci	ience ir	n Fo	rensic S	Scienc	e				
Semester				r of first year of the programme								
Course		1. Explore scope, ethics, and expert witness role.										
Objective	S	2. Analyze causes, impact, bystander effect, mental health.										
		3. Study profiling, testimony, competence, treatment, special populations.										
		4. Learn tests, detection methods, lie detection, applications.5. Develop competences, interviewing skills, legal role, psychotherapy practices										
CO1											a mala	
COI		Understand the nature, history, and scope of forensic psychology, distinguishing its role from traditional psychology and law										
CO2		from traditional psychology and law. Identify the causes and analyze the impact of crime on victims, exploring victimization										
002			ging it, such as the b				, ciiiis,	САРІО	ing vi	Ctililiz	ation	
CO3			riminal profiling, fac				estimo	nv. co	mpeter	ice to	stand	
			the roles of correc		-			•				
		aspects using real li										
CO4		Discuss psychologi	cal tests and forens							_		
			on Signature Profili				detect	ion m	ethods	along	with	
~~-			ets using real life cri				1 .					
CO5			sic consultancy and								ncies,	
Unit-		Conte	ing techniques, and	Conta					tcome		KL	
No.		Conte	IL	Hou		ı	æariii	ng Ou	tcome		KL	
110.	Inti	roduction to forensic	Psychology	1100	11	Under	stand t	orensi	c			
		ure, History and its S			psycho				es.			
	1	inctions between Psy			pojoni	,108)	устор	, • • • • • • • • • • • • • • • • • • •				
_		ice Psychology, Fore	_							1.0		
I			5							1,2		
		a and its sub-fields.										
		es in Forensic Practice, Psychologist as										
	_ ^	ert Witnesses.										
		ne: Causes, impact o				Analyz		ne cau	ses, vi	etim		
		timization, Factors a	C			impact	ι.					
	1	imization: Bystander										
II		ntal Health. Psycholo	C 1	7							1,2	
	1 1	pecific crime types:										
	hon	nicides, sexual offen	es, burglary,									
	robl	pery, theft, white col	lar crimes.									
	l	ninal Profiling, Eyev				Study			mpeter	ice,		
	Con	npetence to stand tria	al, Roles of			correc	tional	roles				
	corr	ectional psychologis	t, Treatment and									
III	Reh	abilitation in Correc	tional facilities,	8							1,2	
	Risl	x Assessment, Treatr	ment of Special									
	pop	ulation: Violent Offe	enders, Women									
	Pris	oners, Juvenile Justi	ce.									
		vchological Tests use				Learn	tests.	letecti	on met	hods.		
		chology, Forensic m				lie det			,	-,		
137	l	rime: Brain Electrica		_							1 2	
IV		nature Profiling (BE		5							1,2	
		ections: Polygraph, I	Brain Mapping,									
		co-analysis.	1			D '		1,	1 **	1		
V		ensic consultancy an		5		Develo			on skıl	IS,	1,2	
	com	petences, Cognitive	merviewing			legal i	eraci	лоп			-,-	

	techniques, psychologist as a consultant, Family law issues, custody and adoptions, Psychology and the legal process interaction, Presentation of evidences and providing feedback, Psychotherapy with Criminal Offenders		
Practical	 To review a crime case involving serial murders. Remark on the accused's psychological traits. To compile a report on the connection between forensic psychology and mental disorders. To examine a criminal case in which deception was found using hypnosis. To review a criminal case involving serial murder To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile. To provide an example of a criminal case where narco analysis was employed to uncover deceit 	30	1,2, 3,4

T1: Arrigo: Introduction to forensic Psychology

REFERENCE BOOKS:

- R1: Cooke, G.: The role of Forensic Psychologist. Chanles C. Thomas.
- R2: A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York.
- R3: J.C. DeLadurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York.
- R4: Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C.
- R5: J. Niehaus, Investigative Forensic Hypnosis, CRC Press, Boca Raton.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Understand the nature, history, and scope of forensic psychology, distinguishing its role from traditional psychology and law.	1,3					
2	Identify the causes and analyze theimpact of crime on victims, exploring victimization and factors influencing it, such as the bystander effect.	1, 2					
3	Access crime for criminal profiling, factors, eyewitness testimony, competence to stand trial, and explain the roles of correctional psychologists along with their practical aspects using real life criminal cases.	1, 2, 3, 6					
4	Discuss psychological tests and forensic methods for crime detection, including Brain Electrical Oscillation Signature Profiling (BEOS) and lie detection methods along with their practical aspects using real life criminal cases.	1, 3, 8					
5	Demonstrate forensic consultancy and supervision, emphasizing core competencies, cognitive interviewing techniques, and psychotherapy with criminal offenders.	1,3					

		SEMESTER –	- II									
Course Ti	tle	Fingerprints &	Other In	npress	sions							
Course co	de 24BSFS123R	Total credits: 4	L	T	P	S	R	O/F	C			
		Total hours: 45T+301	P 3	0	2	0	0	0	4			
Pre-requi	site Nil	Co-requisite				Nil						
Programn	ne	Bachelor of Science in Forensic Science										
Semester	W	inter/ II semester of fi	irst year	of the	prog	ramm	e					
Course	1. Understand the	historical development	and biolo	gical 1	founda	tion of	ffinge	rprints	•			
Objective	s 2. Analyze and into	erpret fingerprint patter	ns, ridge	charac	eters, a	nd mii	nutiae.					
	3. Explore the class	3. Explore the classification and cataloging of fingerprint records, including the use of										
	automated syste	automated systems.										
	4. Investigate the	constituents of sweat re	esidue and	d emp	loy va	rious 1	metho	ds for	latent			
	fingerprint detec											
		constituents of sweat re	esidue and	d emp	loy va	rious	metho	ds for	latent			
	fingerprint detec											
CO1		istorical facts and basic	•									
CO2		fingerprint patterns,		_	_							
		ngerprints found at crin										
	^	n and cataloging of fing	- 1			_		•				
CO3		and understand the significance of poroscopy and edgeoscopy along with their practical										
	*	aspects.										
604		Analyze and interpret latent fingerprints through physical and chemical methods,										
CO4	^	preservation, and lifting, including digital imaging techniques along with their practical										
	1 -	aspects.										
CO5	_	Illustrate the importance of footprints casting techniques, electrostatic lifting of latent footprints, and understand the historical significance of palm prints and lin prints along										
COS	1 -	footprints, and understand the historical significance of palm prints and lip prints along with their practical aspects.										
Unit-	Conte		Contact	Τ	Learn	ing ()	utcom	ıe.	KL			
No.		,	Hour			S						
	Introduction and History	7. Biological basis of		Und	lerstan	ding fi	ngerpi	rint				
I	fingerprints. Formation	•	8	ory and	_	0 1		1,2				
	Fundamental principles				•							
	Fingerprint patterns. Ric			Rec	ognize	finge	rprint 1	oattern				
	characters/minutiae. Pla	in and rolled		and	minut	iiae.						
II	fingerprints. Ridge Trac	ing and Ridge	7						1,2			
	Counting. Types of Fing	gerprints found at										
	Crime Scene.											
	Classification and catalo	oguing of fingerprint		Clas	ssify fi	ngerpi	ints ar	nd use				
	record. Automated Finge	erprint Identification		iden	tificat	ion sys	stems.					
III	System. Significance of	poroscopy and	10						1,2			
	edgeoscopy. Ten Digit (Classification. Single										
	Digit Classification.											
	Constituents of sweat re				ect, pro							
	fingerprints' detection b			enha	ance fi	ngerpi	rints					
	chemical methods. Prese	~										
IV	developed fingerprints.		10						1,2			
	fingerprint enhancement	t. Fingerprinting the										
	deceased											
i				1					ĺ			

	Importance of footprints. Casting of foot		Grasp footprints,	palm	
	prints, Electrostatic lifting of latent foot		prints, lip prints.		
V	prints. Palm prints and their historical	10			1,2
	importance. Lip prints - Nature, location,				
	collection and examination of lip prints.				
	1. To obtain plain fingerprints.				
	2. To obtain rolled fingerprints.				
	3. To identify core and delta in the given				
	fingerprint sample				
	4. To identify pattern types in the given				
	fingerprint sample.				
	5. To perform ridge counting in the given				
	fingerprint sample				
Practical	6. To perform ridge tracing in the given	30			1,2,
Tractical	fingerprint sample	50			3,4
	7. To identify ridge characteristics or				
	minutiae in given fingerprint sample				
	8. To develop latent fingerprint using				
	powder method				
	9. To develop and lift latent finger Prints				
	with fuming and chemical methods.				
	10. To compare two fingerprint samples				
	11. To prepare cast of foot prints.				

T1: Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton.

REFERENCE BOOKS:

R1: J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton.

R2: D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton.

R3: C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Understanding the historical facts and basic concepts of fingerprinting.	1				
2	Analyze various fingerprint patterns, including ridge characters/minutiae, and differentiate types fingerprints found at crime scenes along with their practical aspects.	1, 3				
3	Explain classification and cataloging of fingerprint records, including automated systems, and understand the significance of poroscopy and edgeoscopy along with their practical aspects.	1,2, 8				
4	Analyze and interpretlatent fingerprints through physical and chemical methods, preservation, and lifting, including digital imaging techniques along with their practical aspects.	1, 2, 3, 8				
5	Illustrate the importance of footprints casting techniques, electrostatic lifting of latent footprints, and understand the historical significance of palm prints and lip prints along with their practical aspects.	1, 3, 8				

Course code 24UBPD122R	nd homony nd phrases. come barri erent tense tiate betwee orporate idi	es, and									
Course code 24UBPD122R Total hours: 60P 0 0 4 0 0	rious tenses and homony and phrases. come barri erent tenses tiate betwee proporate idi	es, and een ioms									
Pre-requisite Nil Co-requisite Nil Programme Bachelor of Science in Forensic Science Semester Winter/II Semester of First year of the programme 1. To equip students with the skills to interchange sentence types, use various correct common grammatical errors. 2. To enable students to effectively use one-word substitutions, understand and homophones, avoid commonly confused words, and use idioms are 3. To help students understand the nature and types of listening, and over effective listening. CO1 Provide students with the ability to transform sentence types, utilize different address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incompany and phrases in their vocabulary. CO3 Assist students in comprehending the various aspects and types of listentidentifying and overcoming obstacles to effective listening. CO4 Facilitate students in employing effective reading strategies, extracting rinformation from texts, and utilizing the SQ3R method.	rious tenses and homony and phrases. become barri derent tenses tiate between proporate idi and, and in	es, and even									
Programme Bachelor of Science in Forensic Science	nd homony nd phrases. come barri erent tense tiate betwee orporate idi	es, and									
Course	nd homony nd phrases. come barri erent tense tiate betwee orporate idi	es, and									
Course Objectives Course C	nd homony nd phrases. come barri erent tense tiate betwee orporate idi	es, and									
Course Objectives Course Objectives Course Objectives Course Objectives Course Objectives Course Course Objectives Course Course Objectives Course Co	nd homony nd phrases. come barri erent tense tiate betwee orporate idi	es, and									
Course Objectives 2. To enable students to effectively use one-word substitutions, understar and homophones, avoid commonly confused words, and use idioms are 3. To help students understand the nature and types of listening, and over effective listening. Provide students with the ability to transform sentence types, utilize different address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incompand phrases in their vocabulary. CO3 Assist students in comprehending the various aspects and types of listentidentifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	erent tense tiate between proporate idi	es, and									
and homophones, avoid commonly confused words, and use idioms ar 3. To help students understand the nature and types of listening, and over effective listening. Provide students with the ability to transform sentence types, utilize different address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incompand phrases in their vocabulary. Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	erent tense tiate between proporate idi	es, and									
3. To help students understand the nature and types of listening, and over effective listening. Provide students with the ability to transform sentence types, utilize different address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incompand phrases in their vocabulary. Assist students in comprehending the various aspects and types of listential identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	erent tense tiate betwe prograte idi	es, and									
Provide students with the ability to transform sentence types, utilize different address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incommon and phrases in their vocabulary. Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	tiate betwe orporate idi	een									
address common grammatical mistakes. Empower students to proficiently apply one-word substitutions, different homonyms and homophones, avoid frequently confused words, and incommon and phrases in their vocabulary. CO3 Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	tiate betwe orporate idi	een									
CO2 Empower students to proficiently apply one-word substitutions, differen homonyms and homophones, avoid frequently confused words, and incomplete and phrases in their vocabulary. CO3 Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	orporate idi	ioms									
homonyms and homophones, avoid frequently confused words, and incomprehensial and phrases in their vocabulary. CO3 Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.	orporate idi	ioms									
and phrases in their vocabulary. Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting r information from texts, and utilizing the SQ3R method.	ing, and in										
Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. CO4 Assist students in comprehending the various aspects and types of listent identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting reinformation from texts, and utilizing the SQ3R method.											
identifying and overcoming obstacles to effective listening. Facilitate students in employing effective reading strategies, extracting r information from texts, and utilizing the SQ3R method.											
Facilitate students in employing effective reading strategies, extracting r information from texts, and utilizing the SQ3R method.											
information from texts, and utilizing the SQ3R method.	1 .										
Instruct students on the significance of time management and provide for	Instruct students on the significance of time management and provide foundational										
	strategies to manage their time efficiently.										
CO6 Lead students in creating a well-rounded and professional LinkedIn prof	ile										
Unit- Contact											
No. Content Contact Hour Learning Outco	me	KL									
Grammar (flipped classroom) Students will accurate	ly										
i. Interchange of Interrogative and construct and transfor											
Assertive Sentences, Exclamatory and 6 various sentence types	I	1,2, 3									
Assertive Sentences correct grammatical e	rrors.	1,2, 3									
ii. Types of Tenses											
iii. Common Errors	.1 .										
Vocabulary Development Students will enhance											
One word substitution II Homonyms and Homophones output vocabulary and use w accurately in context.	orus	1,2, 3									
Words often confused		1,2, 3									
Idioms and phrases											
Listening Skills Students will demonst	trate										
i What is listening?	I	1.0.0									
ii. Types of Listening 5 identify listening barr	I	1,2, 3									
iii. Understanding Listening Barriers											
Reading Skills Students will read effi	ciently										
i. Techniques of Effective Reading and extract relevant											
IV ii. Gathering ideas and information from 5 information using the	SQ3R	1,2, 3									
a text technique.											
iii. The SQ3R Technique	1										
Time-Management Skills Students will effective manage their time weight	-										
i. Introduction to Time Management ii. Purpose and Importance of Time ii. Purpose and Importance of Time 4 various strategies.	ng	122									
V ii. Purpose and Importance of Time 4 various strategies. Management		1,2, 3									
iii. Basic Tips to Maintain Time											
Students will create a											
VI Creation of LinkedIn Profile 6 professional LinkedIn		2, 3									

- T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2: Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- T3: Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- T4: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

REFERENCE BOOKS:

- R1: Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial R2: Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- R3: Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- R4: Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

OTHER LEARNING RESOURCES:

https://www.ef.com/wwen/english-resources/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Provide students with the ability to transform sentence types, utilize different tenses, and address common grammatical mistakes.	2,3,4,8				
2	Empower students to proficiently apply one-word substitutions, differentiate between homonyms and homophones, avoid frequently confused words, and incorporate idioms and phrases in their vocabulary.	2,3,4,8				
3	Assist students in comprehending the various aspects and types of listening, and in identifying and overcoming obstacles to effective listening.	2,3,4,8				
4	Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.	2,3,4,8				
5	Instruct students on the significance of time management and provide foundational strategies to manage their time efficiently.	2,3,4,8				

		SEMESTER – II Environmental Science											
	se Title							_					
Cours	se code	24BSFS127		credits: 2	I		T	P	S	R	O		C
_		R		hours: 301		2	0	0	0	0)	2
	equisite	Nil		-requisite				. ~ .		lil			
	amme			helor of So									
Semester Winter/II Semester of First year of the programmer Course 1. To prepare students for careers as leaders in understanding										•			
Cours													
Objec	tives	complex environmental issues from a problem-oriented, interdisciplinary perspective.										.	
		2. To develop a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, Skills, attitudes,											
		motivations and con											
		current problems and				any	ana	COHEC	tively	towar	us 501	unons	01
		3. To gain kno	_			tion	of b	iodive	ersity a	and its	impo	rtance).
(CO1	The students will be											
	,01	of environmental iss											
	CO2	Students will learn a										npacts	of
		Human activities on				1						•	
	CO3	Gain knowledge abo	out envi	ronment an	d ecosy	ster	n, Stu	idents	will t	e able	to un	dersta	ınd
		the concept of biodi	versity a	and respect	them								
	CO4	Gain knowledge abo											
C	CO5	Aware students abou			ironmen	ıtal	pollu	tion, i	ts imp	act on	huma	ın and	
	T	· · ·	tem and control measures.							1			
Unit-		Content		Contact		I	Learn	ing O	utcon	ne		K	L
No.	3.6 1.11	• 1•		Hour	Б.		. 1	. 1.		1 .		1	
I		sciplinary nature of	:4:	4	Enviro							1,	,2
		*					sciences to tackle environmental issues. Its multidisciplinary approach						
	scope and importance, Need for public awareness.												
	paone a	is key to solving complex problems. Public awareness and education are											
					vital for promoting sustainability								
II	Natural	Resources: Renewa	ble	6	Natura	_						1.	,2
	and non	-renewable resource	es,		and no	n-r	enew	able, 1	ace ex	kploita	tion		
	Natural	resources and associa	ted		issues,	, inc	cludin	g def	orestat	tion,			
	•	s. Forest resources: U			overus					-			
	_	ploitation, deforestation			enviro				_				
		dies. Timber extractio			minera								
		dams and their effects			degrad				-	•			
		nd tribal people. Wate s: Use and over-utiliz			crucial and pro						es		
		ce and ground water, f			and pro	OHI	Jung	ouotal	ıια∪III	cy.			
		conflicts over water,											
	_	and problems. Minera											
		es: Use and exploitation											
		nental effects of extra	_										
		g mineral resources, o											
		Food resources: Worl	d food										
	_	s, changes caused by	ffort-										
	_	ıre and overgrazing, e											
		rn agriculture, fertiliz e problems, water log											
	_	case studies. Energy	51118,										
		es: Growing energy ne	eds.										
		le and non-renewable											
		ources, use of alterna											
	energy s												
		dies. Land resources:	Land										
	as a reso	ource, land degradation	n,										

III	man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the Following ecosystem: - Forest ecosystem, Grassland ecosystem,	4	This module covers ecosystems, including their concept, structure, functioning, and diversity. Students will learn about energy flow, ecological succession, and various ecosystem types like forests, grasslands, deserts, and aquatic ecosystems.	1,2
IV	Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a megadiversity nation• Hot-sports of biodiversity: habitat loss, poaching	5	This module covers biodiversity, including its definition, value, levels, and threats. Students will learn about India's bio-geographical classification, its status as a megadiversity nation, and key biodiversity hotspots. They'll also explore threats like habitat loss, wildlife poaching, and human-wildlife conflicts, crucial for conservation efforts.	1,2
V	of wildlife, man-wildlife conflicts. Environmental Pollution: Definition Cause, effects and control measures of:- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste, Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.	5	This module covers environmental pollution, including causes, effects, and control measures, alongside waste management and disaster preparedness strategies.	1,2
VI	Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case Studies. Environmental ethics: Issues and	6	This module explores social- environmental dynamics, including urban energy challenges, water conservation, and resettlement issues. It delves into environmental ethics, climate change impacts, and relevant legislation like the Environment Protection Act, emphasizing public awareness and enforcement challenges.	1,2

	possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Waste land reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.			
VII	Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.	4	This module covers human population dynamics, including growth, impact on the environment and health, along with initiatives like Family Welfare Programs and the role of information technology, illustrated with case studies.	1,2
VIII	Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)	5	Fieldwork objectives include documenting environmental assets like rivers and forests, assessing pollution in urban or rural sites, and studying local biodiversity and ecosystems such as ponds and hill slopes	1,2

T1: Bharucha. Textbook of Environmental Studies for Undergraduate Courses. 2nd edition. Orient Black swan Publishing; 2019.

REFERENCE BOOKS:

- R1: Trivedi Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media(R). B.S. Publications; 2010.
- R2: Trivedi, Goel. Introduction to air pollution. 1st publication. Techno-Science Publication (TB); 2003.
- R3: Brunner. Hazardous Waste Incineration. 2nd edition. McGraw Hill Inc.; 1994

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning PlatformsP[

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	The students will be able to appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.	1, 4
2	Students will learn about natural resource, its importance and environmental impacts of Human activities on natural resource	1, 4
3	Gain knowledge about environment and ecosystem, Students will be able to understand the concept of biodiversity and respect them	1, 4
4	Gain knowledge about the conservation of biodiversity and its importance.	1, 4
5	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.	1, 2, 4

		SEMESTER – II									
Course Tit	le	Chemi	stry- 2								
Course cod	le 24FSCH124R		L	T	P	S	R	O/F	C		
		Total hours: 30T + 30P	2	0	2	0	0	0	3		
Pre-requisi	ite Nil	Co-requisite				Nil					
Programm	e	Bachelor of Science in Forensic Science									
Semester		Winter/ 2 nd semester of f	irst ye	ar of t	he pr	ogran	1				
Course		he principles of isomerism, i									
Objectives		and chemical properties of	alkane	es, alke	enes,	and al	kynes	, along	with		
	mechanisms 2 Explore the	formation and chemical re-	actions	of al	kvl h	alides	and s	arvl ha	lides		
		nucleophilic substitution rea						aryr ma	nacs,		
		versible and reversible reacti						law of	mass		
		ne thermodynamic treatment									
		s into various types of chemi							eories		
		s theory, Valence Bond theoracid-base reactions through							vated		
		ling solvents, Lewis acid-bas									
	Soft Acids an	nd Bases (HSAB) principle.		-							
CO1		diverse isomerism and mast			sical	and c	hemic	al prop	erties		
CO1		nes, alkynes, and aromatic co			and.	ma a a la c		imrealr.	من اده		
CO2		dling the methods of formati	on, rea	ictions	, and	шеспа	ımsms	invoiv	ea m		
CO3		alkyl and aryl halides. Explain chemical equilibrium principles, Le Chatelier's principle, and their applications.									
CO4	Identify chemic	al bonding, structure, and									
	molecular orbita										
CO5		Describe application of acid-base concepts, including Brönsted-Lowry, Lewis theories, and the Hard and Soft Acids and Bases (HSAB) principle									
and the Hard and Soft Acids and Bases (HSAB)				_							
Unit-No.		Content	Con	tact	Le	arnin	o Onto	rome	KL		
Unit-No.		Content		itact our	Le	arnin	g Outo	come	KL		
Unit-No.		methods of formation,					g Outo		KL		
Unit-No.	Isomerism, sources,				Mas	ter hy		bon	KL		
Unit-No.	Isomerism, sources,	methods of formation, and chemical reactions of			Mas prop	ter hy	drocar	bon	KL		
Unit-No.	Isomerism, sources, physical properties alkanes, alkenes, all	methods of formation, and chemical reactions of			Mas prop	ter hy	drocar	bon	KL		
Unit-No.	Isomerism, sources, physical properties alkanes, alkenes, all	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann			Mas prop	ter hy	drocar	bon	KL		
Unit-No.	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoffs	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their			Mas prop	ter hy	drocar	bon	KL		
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and	Но	our	Mas prop	ter hy	drocar	bon			
Unit-No.	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. S	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann vnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and	Но		Mas prop	ter hy	drocar	bon	KL 1,2		
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subutadiene, Diels-Ale	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity,	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Al-Huckel's rule, arom	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes,	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subtadiene, Diels-Ale Huckel's rule, arome cyclic carbocations/	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subtadiene, Diels-Ale Huckel's rule, arome cyclic carbocations/compounds with suitans.	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples,	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Ald Huckel's rule, arom cyclic carbocations/compounds with subantiaromaticity& no	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation,	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Ale Huckel's rule, arom cyclic carbocations/compounds with sufantiaromaticity& no physical and chemic	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, eal properties of arenes	Но	our	Mas prop	ter hy	drocar	bon			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Al-Huckel's rule, arom cyclic carbocations/compounds with sufantiaromaticity& no physical and chemic (especially benzene	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, all properties of arenes	Но	our	Mas prop aron	eter hy perties naticit	drocar, react	bon ions,			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subtadiene, Diels-Ale Huckel's rule, arome cyclic carbocations/compounds with suffantiaromaticity& not physical and chemic (especially benzene).	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, all properties of arenes on, chemical reactions of	Но	our	Mas prop aron	erstan	drocar, react	bon ions,			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subtadiene, Diels-Ald Huckel's rule, arome cyclic carbocations/compounds with subantiaromaticity& not physical and chemical (especially benzene). Methods of formatical alkyl halides and argument of the source of the so	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, eal properties of arenes on, chemical reactions of yl halides. Mechanisms of	Но	our	Mas prop aron	erstan	drocar, react	bon ions,			
	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Ald Huckel's rule, arom cyclic carbocations/compounds with sufantiaromaticity& no physical and chemic (especially benzene Methods of formaticalkyl halides and armucleophilic substitutions).	methods of formation, and chemical reactions of types along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, all properties of arenes on, chemical reactions of	Ho	our	Mas prop aron	erstan	drocar, react	bon ions,			
I	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolate cumulated dienes. Subtadiene, Diels-Ald Huckel's rule, arome cyclic carbocations/compounds with suffantiaromaticity& not physical and chemic (especially benzene). Methods of formatically halides and armucleophilic substitutionals.	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, eal properties of arenes on, chemical reactions of yl halides. Mechanisms of attor reactions of alkyl	Ho	our 7	Mas prop aron	erstan	drocar, react	bon ions,	1,2		
I	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Ald Huckel's rule, arom cyclic carbocations/compounds with suffantiaromaticity& no physical and chemic (especially benzene Methods of formaticalkyl halides and armucleophilic substitution).	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, cal properties of arenes on, chemical reactions of whalides. Mechanisms of ation reactions of alkyl 1 mechanism. Nucleophilic	Ho	our 7	Mas prop aron	erstan	drocar, react	bon ions,	1,2		
I	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involved elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subutadiene, Diels-Ald Huckel's rule, arome cyclic carbocations/compounds with suffantiaromaticity& not physical and chemic (especially benzene). Methods of formaticalkyl halides and armucleophilic substitution and the elimination-	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, all properties of arenes on, chemical reactions of yl halides. Mechanisms of atton reactions of alkyl 1 mechanism. Nucleophilic in, the addition elimination	Ho	our 7	Mas prop aron	erstan	drocar, react	bon ions,	1,2		
I	Isomerism, sources, physical properties alkanes, alkenes, all mechanism involve elimination, Markov Antimarkownikoff's classification: isolat cumulated dienes. Subtadiene, Diels-Al-Huckel's rule, arom cyclic carbocations/compounds with sufficient and chemic (especially benzene Methods of formaticalkyl halides and armucleophilic substitution and the elimination-nucleophilic aromatical	methods of formation, and chemical reactions of tynes along with the d. Saytzeff's rule, Hofmann wnikoff's rule, rule. Dienes and their ed, conjugated and tructure of allenes and der reaction. Aromaticity, atic character of arenes, carbanions & Pheterocyclic table examples, naromaticity; Preparation, eal properties of arenes on, chemical reactions of yl halides. Mechanisms of ation reactions of alkyl 1 mechanism. Nucleophilic in, the addition elimination additional mechanisms of	Ho	our 7	Und form mec	erstan nation hanisi	drocar, react	de ions,	1,2		

	equilibrium, law of mass action,		principles, Le	
	thermodynamic treatment of law of mass		Chatelier's principle	
	action, Van't Hoff reaction isotherm, relation			
	between Kp, Kc &K x, homogenous &			
	heterogenous equilibria, Le Chatelier's			
	principle, applications of Le Chatelier's			
	principle, Clausius-Claperyron equation.			
	Types of bonds: lonic bond, Covalent bond and		Comprehend bond	
	Co-ordinate bonds. Oxidation number. Lewis		types, hybridization,	
	theory, Formal charge, Valence Bond theory,		molecular orbitals.	
	Energetics of hybridization, equivalent and			
	non-equivalent hybrid orbitals. Valence shell			
13.7	electron pair repulsion theory (VSEPR), Bent's	_		1.2
IV	rule, Molecular orbital theory. Molecular	5		1,2
	orbital diagrams of diatomic and simple			
	polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO,			
	NO, HCl, CO ₂ . Covalent character in ionic			
	compounds, polarizing power and			
	polarizability. Fajan's rules.			
	Brönsted-Lowry concept of acid-base reactions,		Master acid-base	
	solvated proton, relative strength of acids, types		concepts, Lewis	
V	of acid-base reactions, levelling solvents, Lewis	5	theory.	1 2
V	acid-base concept, Classification of Lewis	5		1,2
	acids, Hard and Soft Acids and Bases (HSAB).			
	Application of HSAB principle			
	1.Qualitative analysis of inorganic salts.			
	• Cations: Pb^{2+} , $Cu^{2+}As^{3+}$, $A\ell^{3+}$, Fe^{3+} , Mn^{2+} ,			
	$\underline{Zn^{2+}}, Ni^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}$			
	• Anions: $(CO_3)^{2-}$, S^{2-} , $(SO_3)^{2-}$, $(NO_2)^{-}$, $(SO_4)^{2-}$,			
	$C\ell^-, Br^-, \Gamma^-, (PO_4)^{3-}, (C_2O_4)^{2-}, CH_3COO^-,$			1.2
Practical	<u>NO_3</u> =	30		1,2, 3,4
	2.Qualitative organic analysis.			3,4
	• Detection of elements (N, S, Halogens)			
	Detection of organic functional groups			
	(-COOH, PhOH, -CHO, =CO, -OH, -NO ₂ , -			
	NH ₂			

T1: Shriver & Atkins Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Michael Hagerman, Oxford.

REFERENCE BOOKS:

- R1: Organic Chemsitry, Robert Thornton Morrison, Robert Neilson Boyd and Saibal Kanti Bhattacharjee, 7th Edition, Pearson IN.
- R2: Organic Chemsitry, Jonathan Clayden, Nick Greeves and Stuart Warren, 2nd Edition (South Asia Edition), Oxford.
- R3: Physical Chemistry by Gurdeep Raj; Krishna Prakashan Media (P) Ltd
- R4: Physical Chemistry by Puri Sharma Pathania; Vishal Publishing Co.
- R5: Inorganic Chemistry, J. D. Lee. Concise, 5 th Edition, Oxford.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Understand the diverse isomerism and mastering the physical and chemical properties of alkanes, alkenes, alkynes, and aromatic compounds.	1				
2	Interpret in handling the methods of formation, reactions, and mechanisms involved in alkyl and aryl halides.	1				
3	Explain chemical equilibrium principles, Le Chatelier's principle, and their applications	1				
4	Identify chemical bonding, structure, and hybridization principles in the context of molecular orbitals.	1				
5	Describe application of acid-base concepts, including Brönsted- Lowry, Lewis theories, and the Hard and Soft Acids and Bases (HSAB) principle.	1				

			SEMESTER – I	I								
Course Ti	tle			ics- 2								
Course coo	le	24FSPH125R	Total credits: 3	I	T	P	S	R	O/F	С		
			Total hours: 30T + 30P	2	0	2	0	0	0	3		
Pre-requis	ite	Nil	Co-requisite		ı		Nil					
Programm	ie		Bachelor of Science	in Forens	ic Scie	nce						
Semester			Winter/ 2 nd semester of	first year o	of the p	rogra	am					
Course		1. Grasp electric f	ields, Gauss' Law, and cor	nservative 1	nature	of elec	ctrosta	itics.				
Objectives		2. Understand pol	arization, dielectric effects	s, and elect	ric dis _l	olacen	nent ii	n mat	ter.			
			c fields, calculate forces, a	_	_			ions.				
		4. Study magnetiz	ation, susceptibility, and f	erromagne	tism in	mate	rials.					
		5. Investigate elec	etromagnetic induction, N	laxwell's	Equation	ons, a	nd ci	cuit	pheno	mena		
		like resonance.										
CO1		-	ntal electrostatic concepts		-			auss'	Law,	and		
CO2			ing them to charge distrib					ties	offoat:	vel.,		
(02			ic fields in matter, polarise Law in dielectrics	zanon, and	uicie	лис р	noper	ues,	CHECH	very		
CO3			oply magnetic forces, Biot	-Savart's L	aw, A	mpere	's Cir	cuita	l Law,	and		
		properties of the	magnetic field to calcul			•						
004		systems.	· · · · · · · · · · · · · · · · · · ·	, • 4	114	1	-	*1**	1			
CO4			Explain magnetization, magnetic intensity, susceptibility, and permeability, exploring									
CO5		ferromagnetism and understanding the B-H curve and hysteresis. Demonstrate proficiency in electromagnetic induction principles, including Faraday's										
		Law, Lenz's Law, and an introduction to Maxwell's Equations, applying them to AC										
			e, and power dissipation									
Unit-No.		Со	ntent	Contact	Lea	ırning	g Out	come	· I	ΚL		
			C 111 F1	Hour				. •				
		*	field lines. Electric flux.		1	p elec Gauss						
		uss' Law with appl	erical, cylindrical and		and	Gauss	Law					
		-	servative nature of									
I			ectrostatic Potential.						1	1,2		
_			equations. Potential and	7						.,2		
			ole. Force and Torque on									
		•	e of a system of									
		•	Parallel-plate capacitor.									
		ectric Field in matte			Und	erstan	d					
	Pol	larization Charges.	Electrical Susceptibility		pola	rizatio	n and					
II	and	d Dielectric Constan	nt. Capacitor (parallel		diele	ectrics			1	1,2		
111	pla	te, spherical, cylind	lrical) filled with	5						1,4		
		-	ent vector D. Relations									
			Gauss' Law in dielectrics									
		-	en current elements and		1	ulate 1	-					
		•	Field B. Biot-Savart's		force	es and	fields	}				
			plications: straight wire									
***		-	pere's Circuital Law and									
III			noid. Properties of B	8						1,2		
		-	netic Force on point									
		-	g wire between current									
		ments, Torque on a form Magnetic Fie	•									
13.7		ignetization vector			Ana	vze			+ ,			
IV	1415	ignenzation vector	(1v1), IVIagnetie		Alla	ıyzc				1,2		

	Intensity(H), Magnetic Susceptibility and	5	magnetization and	
	permeability. Relation between B, H, M.		magnetic materials	
	Ferromagnetism, B-H curve, and hysteresis.			
	Electromagnetic Induction: Faraday's Law.		Apply	
	Lenz's Law, Self-Inductance and Mutual		electromagnetic	
	Inductance, Charge Conservation and		induction principles	
V	Displacement current. Introduction to	5		1,2
	Maxwell's Equations. Kirchhoff's laws for AC	3		
	circuits. LCR circuit: Resonance, Power			
	Dissipation and Bandwidth			
	1. Use a Multimeter for measuring (a)			
	Resistances, (b) AC and DC Voltages, (c)			
	DC Current, (d) Capacitances, and (e)			
	Checking electrical fuses			
	(f) Resistors and transistors			
	2. To determine the internal resistance of a			
Practical	cell by using potentiometer.	30		1,2,3,4
	3. To study a series LCR circuit and			
	determine its (a) Resonant Frequency			
	4. Place a bar magnet in the magnetic			
	meridian and draw the field lines			
	5. To find the value of a given resistance			
	using a meter bridge			

T1: Elements of Electromagnetics, M.N.O. Sadiku, Oxford University Press.

REFERENCE BOOKS:

- R1: Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.
- R2: Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education.
- R3: Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., Benjamin Cummings.
- R4: Feynman Lectures Vol.2, R.P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- R5: Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol.I, Oxford Univ. Press.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Classify fundamental electrostatic concepts, including electric field, Gauss' Law, and capacitance, applying them to charge distributions of varying symmetry.	1			
2	Understand electric fields in matter, polarization, and dielectric properties, effectively employing Gauss' Law in dielectrics.	1			
3	Understand and apply magnetic forces, Biot-Savart's Law, Ampere's Circuital Law, and properties of the magnetic field to calculate forces and torques in current-carrying systems	1			
4	Explain magnetization, magnetic intensity, susceptibility, and permeability, exploring ferromagnetism and understanding the B-H curve and hysteresis.	1			
5	Demonstrate proficiency in electromagnetic induction principles, including Faraday's Law, Lenz's Law, and an introduction to Maxwell's Equations, applying them to AC circuits, resonance, and power dissipation.	1			

		SEMESTI	ER – II							
Course Tit	le		Biology	- 2						
Course cod	le 24FSBO126R	Total credits: 3		L	T	P	S	R	O/F	C
		Total hours: 307	Г + 30Р	2	0	2	0	0	0	3
Pre-requis	ite Nil	Nil Co-requisite Nil								
Programm	ie	Bachelor of Science in Forensic Science								
Semester		Winter/ 2 nd semest	ter of firs	t yea	ar of th	e pro	gram			
Course		ciples and basis for								
Objectives	2. Explore genera	al characters, classi	fication, a	and 1	ife hist	ories	of maj	or ani	mal ph	ıyla.
	3. Introduce pro	otochordates and	agnatha	, hi	ighlight	ting	gener	al fe	atures	and
	significance in	vertebrate evolution	on							
	4. Cover general	features and classif	fication of	fish	nes, am	phibia	ıns, an	d rept	iles	
	5. Introduce gene	eral features and cla	ssificatio	n of	birds a	nd ma	ımmal	s.		
CO1	Enable compreher								ificatio	n in
	biological sciences									
CO2	Understand the dive	erse animal phyla, t	their char	acter	ristics, a	and ev	olutio	nary s	signific	cance
CO3	Understand protoc								-	
	evolution	3								
CO4	Identify aquatic ada	ptations, parental of	care, and	class	sificatio	ns in	aquati	c vert	ebrates	3.
CO5	Demonstration of f									
	birds and mammals		•		ĺ			J 1.		
Unit-No.	Conte	nt	Contact			rning	g Outo	ome		KL
			Hour				•			
	Basis for Animal King	odom .		U	Indersta	and th	e crite	rion c	on	
	Classification; Phylur	_		l w	vhich a	nimal	kingd	om is		
	General characters and			- 1	lassifie		_			
	to classes; Canal System	- 1		- 1	hylum		-		a.	
	Phylum Cnidaria: Ge	•		- 1	latyhel					
	and classification up to			- 1	Vemath					
_	Polymorphism in Hydr									
I	Phylum Platyhelmint		7							1,2
	characters and classific									
	classes; Life history of	Taenia solium								
	Phylum Nemathelmin									
	characters and classific	ation up to								
	classes; Life history of	Ascaris								
	lumbricoides.									
	Phylum Annelida: Ge	neral characters		R	Regardii	ng dif	ferent			
	and classification up to	classes;		c	haracte	rs of	Anneli	da,		
	Metamerism in Annelio	la		Α	Arthrop	oda, N	Aollus	ca,		
	Phylum Arthropoda:	General		Е	Echinod	ermat	a.			
	characters and classific									
	classes; Metamorphosis	s in Insects								
II	Phylum Mollusca: Ge	neral characters	5							1,2
	and classification up to	classes; Torsion	3							
	in gastropods									
	Phylum Echinoderma	ta: General								
	characters and classific	ation up to								
	classes; Water-vascular	-								
	Asteroidea									

III	Protochordates: General features Agnatha: General features Pisces: General features and Classification up to class; aquatic adaptation of fishes.	8	Regarding different characters of Protochordates, Agnatha and Pisces	1,2
IV	Amphibia: General features and Classification up to class; Parental care in amphibia Reptiles: General features and Classification up to Class; Poisonous and non-poisonous snakes.	5	Regarding different characters of Amphibia and Reptiles.	1,2
V	Aves: General features and Classification up to class; Flight adaptations in birds Mammals: General features and Classification up to orders; Adaptive radiation with reference to locomotory appendages	5	Regarding different characters of Aves and Mammals.	1,2
Practical	 Study of invertebrate museum specimen (two specimen from each phylum). Study of vertebrate museum specimen (two specimen from each phylum). Study of various types of social insects (honeybee/ants) and their nests 	30		1,2,3,

- T1: Ruppert and Barnes, R.D. Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- T2: Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- T3: Pough H. Vertebrate life, VIII Edition, Pearson International

REFERENCE BOOKS:

R1: Ruppert and Barnes, R.D. Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

R2: Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. The Invertebrates: A New Synthesis, III Edition, Blackwell Science.

R3: Barrington, E.J.W. Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Enable comprehension of the rationale behind animal kingdom classification in biological sciences.	1, 6				
2	Understand the diverse animal phyla, their characteristics, and evolutionary significance.	1, 2				
3	Understand protochordates and agnatha characteristics and their role in vertebrate evolution	1				
4	Identify aquatic adaptations, parental care, and classifications in aquatic vertebrates.	1, 6				
5	Demonstration of flight adaptations, adaptive radiation, and locomotory appendages in birds and mammals.	1				

		SEMESTE	R – III							
Course Tit	le		& Digital	Forensi	cs					
Course cod		Total credits: 4			P	S	R	O/F	C	
Total hours: 45T+30P 3 0 2						0	0	0	4	
Pre-requis	ite Nil	Co-requisite				Ni	l			
Programm		Bachelor of Sc								
Semester		all/ III Semester of							rd disk	
Course Objectives	development, n 2. Explore the de from conventio 3. Examine malw in computer cri 4. Learn the prince the seizure, pre 5. Address legal a media, covering	 development, memory, processors, and operating systems. Explore the definition and various types of computer crimes, distinguishing them from conventional crimes. Examine malware, such as computer viruses, worms, Trojan horses, and their roles in computer crimes. Learn the principles and procedures of computer forensics investigations, including the seizure, preparation, and extraction of information from suspected computers. Address legal and privacy issues related to the collection and seizure of magnetic media, covering topics like file restoration, password cracking, encryption methods, 								
CO1		and user tracking.								
COI		Understand the fundamentals of computer hardware, accessories and network								
CO2		connections along with their practical aspects Describe the various cyber and digital crimes along with their practical aspects.								
CO2		Explain various viruses, adware, malwares and their effect along with their practical								
COS	*	aspects.								
CO4	Demonstrate the cybercrimes along	Demonstrate the methods of collection restoration and decryption of data related to cybercrimes along with their practical aspects. Demonstrate analysis of media, files, folder etc. using various computer forensic								
		software and hardware along with their practical aspects.								
Unit-No.	Conte		Contact		earni	ng Qu	tcom	e	KL	
	00.00		Hour							
I	Fundamentals and Cor Fundamentals of comp and accessories- devel disk, physical construct LBA addressing, enco- formats. Memory and of storing data. Operat Software. Introduction WAN and MANI	outers Hardware opment of hard etion, CHS and ding methods and processor. Methods ing system.	8	Funda hardw and n their u	are a	and a	access	sories	1,2	
п	Computer Crimes: Det of computer crimes. D computer crimes and c crimes. Reasons for co computer crimes. Brea operation of digital sys	istinction between conventional emmission of ching security and	crime related to computer.					1,2		

III	Malware and Other Crimes: Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs. Types of computer crimes – computer stalking, pornography, hacking, crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space. An overview of hacking, spamming, phishing and stalking	10	A brief idea about malwares and their effect, categories of crime involving computer and internet.	1,2
IV	Computer Forensics Investigations: Seizure of suspected computer. Preparation required prior to seizure. Protocol to be taken at the scene. Extraction of information from the hard disk. Treatment of exhibits. Creating bitstream of the original media	10	Computer forensic information- preparation, seizure, analysis.	1,2
V	Collection and Seizure of Magnetic Media: Legal and privacy issues. Examining forensically sterile media. Restoration of deleted files. Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users	10	Collection restoration and decryption of magnetic media data.	1,2
Practical	 To identify, seize and preserve digital evidence from crime scenes. To detect deletions, obliterations and modifications of files using cyber forensic software. To identify the IP address of the sender of e-mails. To identify encrypted/hidden files To use digital signatures for securing e-mail and online transactions. To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards cyber forensic software/hardware To carry out imaging of hard disks 	30		1,2,3,4

T1: Verma M., Forensic Computer investigation

REFERENCE BOOKS:

R1: R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, *Computer Crimes and Computer Forensics*, Select Publishers, New Delhi.

R2: C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Understand the fundamentals of computer hardware, accessories and network connections along with their practical aspects.	1, 8				
2	Describe the various cyber and digital crimes along with their practical aspects.	1				
3	Explain various viruses, adware, malwares and their effect along with their practical aspects	1, 3				
4	Demonstrate the methods of collection restoration and decryption of data related to cybercrimes along with their practical aspects.	1, 8				
5	Demonstrate analysis of media, files, folder etc. using various computer forensic software and hardware along with their practical aspects.	1, 3, 8				

			SEMESTEI									
Course Tit			Basic Instr	ument		_						
Course cod	de	24BSFS212R	Total credits: 3	. 207	L	T	P	S	R	O/F	ן י	<u>C</u>
D .	•.	3.703	Total hours: 30T		2	0	2	0	0	0		3
Pre-requis												
Programm Semester	ie	Tr.										
Course			all/III Semester of Surement principles							1α ac	cur	acv
Objectives			ivity, and stability in					cmp	11451211	ig ac	Cui	асу,
Objectives			idents with chroi					, ins	strume	ntatio	n,	and
			nphasizing forensic				1	,				
		3. Introduce specti	coscopy principles,	electro	magr	netic sp	ectru	m, an	d sour	ces, f	ocu	sing
		on forensic appl										
			edge of light micr							e for	mat	ion,
			and types of microsc							1.	:.	_:
			ral principles of bid in forensic science.		ıı and	u bloc	пенис	ai aii	arysis,	empi	iasi	zing
CO1			alculation to validat		ods.	ensurii	ng reli	able a	and pro	ecise f	fore	nsic
			g with their practica			CIII GII II	15 1011		ma pr			11010
CO2			aphic methods for			and a	ıantita	tive s	nalvei	s in f	fore	nsic
002			th their practical asp	_		ana q	aummu		inarysi	5 111 1	.010	11510
CO3			molecular spectros		or for	ensic	analys	is and	Lunder	rstand	ene	erov
			ectra along with thei				-	is unc	i unac	Starra	CII	J15J
CO4		_	-	_		_		tion c	f fore	nsic e	vide	ence
04		Develop skills in microscopic analysis for effective interpretation of forensic evidence along with their practical aspects.										
CO5		Utilize biochemical techniques for analyzing of biological evidence in forensic							nsic			
003		investigations along with their practical aspects.							11310			
Unit-No.		Conte	<u> </u>	Cont		T	aarnii	ıσ Ωιι	tcome		k	KL
Omt-110.		Conte	nt	Hou		12.	cai iiii	ig Ou	tcome	,	1,	KL
	Ba	sic Concepts of Me	thod Validation			Demo	nstrat	e und	erstand	ling		
		roduction to measure							f meth	od		
	ins	instrumentation, methods of measurement Performance characteristics of Instruments: -accuracy, precision,				validation concepts, measurement, and instrumentation,						
	Pe											
I											1	,2
		nsitivity, linearity, re	•			show	casing	profi	ciency	in		
	rep	eatability, resolution	n, threshold, drift,			assess	_		ent			
	sta	bility				perfor						
						chara	cterist	ics.				
	Ch	romatography- Intr	oduction, Review			Apply	chro	matog	raphy			
	of	basic principles and	types of			princi	ples a	nd tec	hniqu	es		
	chi	romatography, thin la	ayer			for qu	ıalitati	ve an	d			
II	chi	romatography, Theor	ry and	5		quant	itative	analy	sis in		1	,2
	ins	trumentation, visual	ization, Qualitative			forens	sic app	olicati	ons,			
	and	d Quantitative, Forer	sic Application.			show	casing	expe	rtise in	1		
						analy	tical n	nethod	ls.			
		omic & Molecular S						•	rincipl			
	Sp	ectroscopy, electrom	agnetic spectrum,			of ato	mic a	nd mo	lecula	r		
	sou	urces of radiation, the	eir utility and			_	_	-	luding	I		
III	lin	nitations, convention	al sources for UV,	8		electr	omagı	netic s	pectru	m,	1	,2
	vis	ible and infrared ray	s, sources for			radiat	ion so	urces	, and tl	neir		
	sho	orter wave length rad	liations, atomic			utility	in for	ensic	analys	sis.		
	spe	ectra, energy levels										
IV	Mi	icroscopy- Light Mi	croscopy-	5		Analy	ze and	dinte	rpret		1	,2

V	Introduction, Geometrical optics, Image formation, Magnification and Resolution, lens aberrations, Distortion of image and curvature of field, Types of microscopes-Compound, Comparison, their basic principles, working and Forensic Applications Biochemical techniques: -Biological and biochemical techniques: general principles of biological/ bio-chemical analysis, Radio Immune Assay (RIA), ELISA.	5	microscopy principles, including geometrical optics, image formation, and magnification, applying these concepts to forensic investigations. Apply biochemical techniques, demonstrating knowledge of general principles and practical application, showcasing proficiency in methods like Radio Immune Assay (RIA) and ELISA in	1,2
Practical	 To prepare sample (various conc., M, %) etc. To understand validation of instrumental methods TO analyze samples using TLC. To analyse sample using UV spectrophotometer To analyse sample using compound microscope To analyse sample using comparison microscope To analyse sample using biochemical techniques 	30	forensic	1,2,3,4

T1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth.

REFERENCE BOOKS:

R1. W. Kemp, *Organic Spectroscopy*, 3rd Edition, Macmillan, Hampshire.
R2. J.W. Robinson, *Undergraduate Instrumental Analysis*, 5th Edition, Marcel Dekker, Inc., New York.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Illustrate various calculation to validate methods, ensuring reliable and precise forensic measurements along with their practical aspects.	1, 3
2	Apply chromatographic methods for qualitative and quantitative analysis in forensic scenarios along with their practical aspects.	1, 3
3	Utilize atomic and molecular spectroscopy for forensic analysis and understand energy levels in atomic spectra along with their practical aspects	1, 3
4	Develop skills in microscopic analysis for effective interpretation of forensic evidence along with their practical aspects.	1, 3
5	Utilize biochemical techniques for analyzing of biological evidence in forensic investigations along with their practical aspects.	1, 3

Total hours: 45T+30P 3 0 2 0 Pre-requisite Nil Co-requisite N						
Total hours: 45T+30P 3 0 2 0 Pre-requisite Nil Co-requisite N		_				
Pre-requisite Nil Co-requisite N	S R O/F	C				
	0 0 0	4				
	Nil					
ProgrammeBachelor of Science in Forensic ScienceSemesterFall/III Semester of Second year of the program	nme					
Course 1. Understand the basics of questioned documents, including		, and				
Objectives procedures for collecting standards for document comparison.	oppes, reigery	,				
2. Explore the principles of handwriting identification, covering p						
individual characteristics, natural variations, and examina	nation of tan	npered				
documents. 3. Evening disputed documents, such as wills, deeds, chaques, s	3. Examine disputed documents, such as wills, deeds, cheques, and various types of					
frauds, including ATM and credit card frauds.	and various ty	pes or				
4. Learn about the examination of security documents, print	ted matter, bu	uilt-up				
documents, and the identification of typists using forensic stylist						
5. Familiarize with instrumentation in questioned documents,	_					
photography, various light sources, magnifying tools, and equipment like Video Spectral Comparator and ESDA.	specialized fo	rensic				
CO1 Identify characteristic features and employ proper procedures for o	document com	parison				
along with their practical aspects		P 4112 011				
CO2 Understand individual handwriting characteristics and analyze ink	k, paper, photo	copies.				
and other document elements along with their practical aspects.	× 1 1 × 1	1				
CO3 Examine diverse disputed documents frequently encountered in for	rensic scenario	s along				
with their practical aspects.						
CO4 Analyze security documents, employing various techniques to deter	rmine authention	city and				
detect forgeries along with their practical aspects.						
CO5 Apply method solving practical skills in utilizing advanced instrum						
and detailed examination of questioned documents along with their	practical aspec	ts.				
Unit-No. Content Contact Learning	Outcome	KL				
Introduction to questioned documents, Introduction, t	to ad-					
types, Forgery and its types, definition, type	•					
characteristic features of genuine preliminary ex						
characteristic features of genuine preliminary ex handwriting/signatures, characteristic and basic tools	s regarding the					
handwriting/signatures, characteristic and basic tools components of forged documents and field	s regarding the					
handwriting/signatures, characteristic and basic tools	s regarding the	1,2				
handwriting/signatures, characteristic and basic tools components of forged documents and field.	s regarding the					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for	s regarding the					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing						
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/genuine/documents/signature/writing Principle of Handwriting Identification: and basic tools field. 8 Instruments us	sed in					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, questioned documents documents and field. 8 Instruments us questioned documents us introduction of handwriting, physiology,	sed in					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and examination.	sed in					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics, natural	sed in					
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics, natural variations in handwriting, causes of	sed in					
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handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics; natural variations in handwriting, causes of variations, disguised writings, its examination, tampered documents: addition, alteration, erasure, obliteration,	sed in	1,2				
I handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics, natural variations in handwriting, causes of variations, disguised writings, its examination, tampered documents: addition, alteration, erasure, obliteration, interlineation, page substitution, secret	sed in	1,2				
I handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics, natural variations in handwriting, causes of variations, disguised writings, its examination, tampered documents: addition, alteration, erasure, obliteration, interlineation, page substitution, secret writing. examination of the documents	sed in	1,2				
handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/ genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics, natural variations in handwriting, causes of variations, disguised writings, its examination, tampered documents: addition, alteration, erasure, obliteration, interlineation, page substitution, secret writing. examination of the documents for the ink, paper, photocopies/xerox,	sed in	1,2				
I handwriting/signatures, characteristic components of forged documents and their examination, procedure for collection of standards for comparison of documents, admitted/genuine/documents/signature/writing Principle of Handwriting Identification: introduction of handwriting, physiology, handwriting characteristics: class and individual characteristics; natural variations in handwriting, causes of variations, disguised writings, its examination, tampered documents: addition, alteration, erasure, obliteration, interlineation, page substitution, secret writing. examination of the documents and basic tools field. Instruments us questioned doc examination.	sed in cuments	1,2				

	cheques, suicide letters, anonymous letters, threatening letters, stamps fraud, counterfeit currencies, fake paintings and printing, ATM and Credit card frauds, fake rubber stamps and seals, charred documents, torn documents, typed and photocopied documents.		by the age of ink, variations, divergences and characteristic of handwriting.	
IV	Examination of security documents. examination of printed matter, examination of built-up documents, determination of sequence of strokes, identification of typist: use of forensic stylistics, examination of other mechanical impressions, examination of paper	10	Standards of comparison of different types of documents.	1,2
V	Instrumentation in Questioned Documents Document photography using Camera, Color filters, Various light sources/Transmitted light, Oblique light/UV/ IR radiations), apparatus for specialized photographic techniques, magnifying glasses, illuminated torch, measuring equipment, geometrical requirements, compound microscope, Stereo microscope, Video Spectral Comparator, Docu-centre, Projectina, ESDA, TLC	10	Different types of forgeries and forged documents.	1,2
Practical	1) Analysis of class and individual characteristics of handwriting 2) Comparison of handwriting exemplars 3) Detection of free hand forgery 4) Detection of forgery by simulation 5) Detection of forgery by tracing 6) Ink identification 7) Examination and photography of security features in Indian rupee notes 8) Examination and photography of security features in Indian passport 9) Determination of sequence of strokes 10) Identification of inkjet printing on a document from laser printing/photocopy	30		1,2,3 ,4

T1: E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants.

REFERENCE BOOKS:

R1. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire.

R2. J.W. Robinson, *Undergraduate Instrumental Analysis*, 5th Edition, Marcel Dekker, Inc., New York.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

CO PO Mapping		
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Identify characteristic features and employ proper procedures for document comparison along with their practical aspects.	1, 3
2	Understand individual handwriting characteristics and analyze ink, paper, photocopies, and other document elements along with their practical aspects.	
3	Examine diverse disputed documents frequently encountered in forensic scenarios along with their practical aspects	1, 3, 5
4	Analyze security documents, employing various techniques to determine authenticity and detect forgeries along with their practical aspects.	1, 3
5	Apply method solving practical skills in utilizing advanced instrumentation for accurate and detailed examination of questioned documents along with their practical aspects	

		SEMESTER	- III									
Course Tit	tle	Fore	nsic Ballist	tics								
Course coo	de 24BSFS214R	Total credits: 4		L	T	P	S	R	O/F	C		
		Total hours: 45T+30		3	0	2	0	0	0	4		
Pre-requis		Co-requisite					Ni					
Programm	ne	Bachelor of Scientific										
Semester		Fall/III Semester of S										
Course		he definition, scope, a	_			orens	ic bal	listics	s, inclu	uding		
Objectives	· ·	d development of gunp				, .			.1	1 6		
		rovised and country-ma		_	ınsho	t resi	dues	and	metho	ds of		
		idues on shooting hand	_		£.		a.a.la			22 2 f		
		Il firearms and ammuand marks produced du			_	_	mecn	anism	is, typ	es oi		
		internal ballistics, cov	_				sh	ne a	nd siz	ze of		
		and factors influencing i	0 1 1		_	111101	, 511	ipe u	110 512	20 01		
		nal ballistics, includir				rv. a	ir re	sistan	ce ef	fects.		
	1	ability, and trajectory	-		-	-						
		•	-									
	injuries.	focusing on the impact of projectiles on targets, ricochet effects, and firearms injuries.										
CO1	Understand the l	nistory and developmen	nt of Gun p	owd	er fir	earm	s, IEI	O, GS	R and	need		
	-	ensic ballistics along wi										
CO2		Firearm and ammunition	on and its c	omp	ositic	n alo	ng w	ith the	eir pra	ctical		
	aspects							~ .				
CO3	_ ^ ^^	and mechanism of series		that t	akes	place	afte	firin	g insid	le the		
CO4		th their practical aspect		1 11	1 . 4	11 1.	41		1	C 41		
CO4		Explain the series of events takes place after the bullet will leave the muzzle of the firearm and factor affecting its velocity along with their practical aspects.										
CO5		ect of bullets after terr			_		_		ng it	along		
	with their practic		innating ai	ia ai	110101	it iac	1015	CSUILI	ing it	along		
Unit-No.	Content	an uspects.	Contact	Learning Outcome KI						KL		
			Hour									
	Definition, Scope, ar	nd Significance of		Int	roduc	tion 1	to bal	listic-				
	Forensic Ballistics; (Gun powder –	need & scope. History and									
	Definition, History a	nd Development.	development of gun									
		earms – Definition according to Indian powder, firearms, ied, gsr-										
I	1	ms Act. History and Development; its collection and analysis.								1,2		
	Improvised & countr	•	8							-,-		
	_	t residues. Methods of										
	, ,	esidues from shooting										
	clothing.	nds and targets, with special reference to										
	Weapon types and th	eir operation Firing		Cla	esific	eation	of fi	rearm	as			
	mechanisms of differ	_			their			. C ai 111	us			
	Types of ammunition			_				ent pa	arts			
	features and characte				bullet			•	-			
***		nd bullets. Primers and								1.2		
II		Projectiles. Different	7							1,2		
	types of marks produ											
	process on cartridge	– firing pin marks,										
	breech face marks, cl	hamber marks,										
	extractor and ejector	marks										

Ш	Internal Ballistics- Definition, ignition of propellants, shape and size of propellants,	10	Detailed study of internal ballistics- series of events	1.2
III	manner of burning, and various factors affecting the internal ballistics	10	takes place after firing inside the firearm.	1,2
IV	External Ballistics- Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability.	10	Detailed study of external ballistics- series of events takes place after the bullet will leave the muzzle of the firearm and factor affecting its velocity.	1,2
V	Terminal Ballistics- Terminal Ballistics, Wound ballistics, nature of injury, Effect of projectile on hitting the target, entry wound, exit wound, multiple entry and exit wound, ricochet and its effects.	10	Detailed study of terminal ballistics- what happens to the bullet and the target after hitting and different factors resulting it.	1,2
Practical	 To identify different parts of firearms To identify different parts of firearm ammunition To perform collection of GSR particles. To perform chemical analysis for presence of GSR. 	30		1,2,3,

T1: B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester.

REFERENCE BOOKS:

R1: K Kumar, Forensic Ballistics in Criminal Justice, Eastern Book Company, Lucknow.

R2: W.F. Rowe, Firearms identification, *Forensic Science Handbook*, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey.

R3: A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand the history and development of Gun powder firearms, IED, GSR and need and scope of forensic ballistics along with their practical aspects.	1, 2, 3
2	Explain types of Firearm and ammunition and its composition along with their practical aspects.	1, 8
3	Explain the type and mechanism of series of events that takes place after firing inside the firearm along with their practical aspects	1, 2
4	Explain the series of events takes place after the bullet will leave the muzzle of the firearm and factor affecting its velocity along with their practical aspects.	2
5	Examine the effect of bullets after terminating and different factors resulting it along with their practical aspects	2

Programme Semester Course Objectives 1. Intro expla 2. Expl and s 3. Prov analy 4. Educ polys 5. Disc syste CO1 Understa contribu CO2 Analyze knowled CO3 Conduct	Total credits Total hours: Nil Co-requisite Bachelor Fall/III Semesteduce the fundamental corrections for specific crime ore the relationship between the chizophrenia, supported ide knowledge on the historist, including detailed case attended to the princing graph, and brain mapping ass the acceptance and appropriate total content of the princing graph, and brain mapping ass the acceptance and appropriate total content of the princing graph, and brain mapping ass the acceptance and appropriate total content of the princing graph, and brain mapping ass the acceptance and appropriate total content of the princing graph, and brain mapping ass the acceptance and appropriate total content of the princing graph.	of Science in ler of Second y cepts of forenses. en criminality by case studies ory, principles e studies, instrument supported by plication of psecond process of the support of the supp	Forensic rear of the sic psychologic and ment detailed of ychologic ology and demental in the siconometric states of the siconome	P S 2 0 Ni Science e program ology and t tal illnesses ares, and sc cocedures, a case studies cal study ev	he psychologies such as necroope of narco- and scope of Es.	cal ophilia BEOS,			
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Programme Semester Course Objectives 1. Intro expla 2. Expl and s 3. Prov analy 4. Educ polys 5. Disc syste CO1 Understa contribu CO2 Analyze knowled CO3 Conduct	Rachelor Fall/III Semest duce the fundamental cortantions for specific crime ore the relationship between the chizophrenia, supported tide knowledge on the hist resis, including detailed cast attentions on the principaraph, and brain mapping the acceptance and appears. In the basic concepts of ting to specific crimes. The relationship between	of Science in ler of Second y cepts of forenses. en criminality by case studies ory, principles e studies. oles, instrument supported by plication of psychocriminality and tanding its his	Forensic tear of the sic psychologic and mentation, proceduration, proceduration detailed of ychologic ology and dimental in the siconometric state of the siconometric state	Ni Science e program plogy and t tal illnesses ares, and sc rocedures, a case studies cal study ev	he psychologies such as necroope of narco- and scope of Es. Vidence in judiological factor	cal ophilia BEOS, cial			
Programme Semester Course Objectives 1. Intro expla 2. Expl and s 3. Prov analy 4. Educ polys 5. Disc syste CO1 Understa contribu CO2 Analyze knowled CO3 Conduct	Bachelor Fall/III Semest duce the fundamental cor mations for specific crime ore the relationship betwee chizophrenia, supported ide knowledge on the hist rsis,including detailed cas ate students on the princi graph, and brain mapping ass the acceptance and ap ms. and the basic concepts of ting to specific crimes. the relationship between ge to case studies. narco-analysis by unders ons in forensic investigat	er of Second y cepts of forenses. en criminality by case studies ory, principles e studies. ples, instrumer supported by plication of ps forensic psych criminality an	ear of the sic psycho and ment s, procedu ntation, prodetailed of ychologic ology and	Science e program plogy and t tal illnesses ares, and sc rocedures, a case studies tal study ev	he psychologies such as necroope of narco- and scope of Es.	pphilia BEOS,			
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CO2 Conduct CO3 Conduct	ting to specific crimes. the relationship between ge to case studies. narco-analysis by unders ons in forensic investigat	criminality and	d mental i		_	18			
CO2 Analyze knowled CO3 Conduct	the relationship between ge to case studies. narco-analysis by unders ons in forensic investigat	tanding its his		illnesses, a	nd apply this				
CO3 Conduct	ge to case studies. narco-analysis by undersons in forensic investigat	tanding its his		a.	iia appiy uiis				
CO3 Conduct	narco-analysis by undersons in forensic investigat		, .						
	ons in forensic investigat		tory, princ	ciples, proc	cedures, and				
	REOS notworanh and hea		3 / 1	1 /1	Ź				
			chniques,	understand	ling their princ	iples,			
	res, and scope in forensic								
	the judicial acceptance a	nd application	of psycho	ological ev	idence in cour	t			
Unit- proceed	ngs. Content	Contact	Т	aarning ()	urtaam a	KL			
No.		Hour		earning O		KL			
	roduction to forensic		1 -		ntal concepts				
1 1	chological explanations of	f 6	6 of forensic psychology.						
specific crime						1,2			
The relationship	of criminality to mental		The ps	ychologica	al factors				
	ilia,Schizophrenia and		_	specific cr					
II their types, case	_	6		opeonic of		1,2			
studies:	•								
	: History, Principle,		Donform	m narco-an	olygic	+			
	•				•				
	s Scope. Detailed Case	6		_	principlesand	1,2			
studies.				ations in fo	orensic	1,4			
P200 2 1	1 D ' ''		_	gations.	1 1 .				
	h, Brain mapping: Histor	·		_	lygraph, and				
_	mentation, Procedure and			11 0	chniques in				
III Scope. Detailed	Case studies	6			, supported by	1,2			
				tanding the					
				oles and pro					
Aspects in judic	ial system: Aspects of				ptance anduse	:			
acceptance of Ps	ychology study evidence	es	of psyc	chological	evidencein				
IV in Courts discus	sions.	6	judicia	l systems,	understanding	1,2			
			its impact on court proceedings						
•	•	· c	Evalua	te the acce	ptance anduse	:			

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Understand the basic concepts of forensic psychology and the psychological factors contributing to specific crimes.	1, 3						
2	Analyze the relationship between criminality and mental illnesses, and apply this knowledge to case studies.	1, 3						
3	Conduct narco-analysis by understanding its history, principles, procedures, and applications in forensic investigations.	1,3						
4	Utilize BEOS, polygraph, and brain mapping techniques, understanding their principles, procedures, and scope in forensic contexts.	1, 8						
5	Evaluate the judicial acceptance and application of psychological evidence in court proceedings.	1, 5						

			SEMEST	TER – II	II						
Course	Title		English I			r excel	lence				
Course	code	24UBPD212R	Total credits: 2		L	T	P	S	R	O/F	C
			Total hours: 60)P	0	0	4	0	0	0	2
Pre-rec	_	Nil	Co-requisite					Nil			
Progra			Bachelor of S								
Semest			Fall/III Semester								
Course		1. To enable students to learn, understand and practice transformation of sentences,									
Objecti	ives	uses of correct p		1.00			1: 0	. .		1	• . •
		2. To augment the writing skills in different areas including CV and cover letter writing.									
		3. To boost productivity and performance at work, which assists in the achievement of professional goals.									
			required attributes in a candidate.								
CO	71	Enable students to	_				mnles	z and	comp	ound	
	<i>J</i> 1	sentences, and disti						r, and	comp	ouna	
CC)2	Teach students the						write	naragi	anhs an	d
	· -	letters, and prepare					5010),		P 8		
CC)3	Help students conduct SWOT analyses, practice self-regulation, and maintain personal									
		hygiene.									
CC)4	Equip students with		ıt non-ve	erbal	l comm	unicat	ion, ty	pes of	f body	
CC)5	language, and their Train students in pl		lating or	101110	diama	iona	offoot	ivolv d	ligagragi	in a
)3	and summarizing to			oup	uiscuss	sions,	enecu	ivery c	iisagieei	ing,
Unit-		Content	ditain objectives	Conta	ct	I	earni	ing O	utcom	e	KL
No.				Hour							
	Gramn	nar: Use of preposition	on, tag			Descri	be pre	positi	on, sir	nple	
I	questic	ons, simple, complex	3		and complex sentences					1,2	
	senten	ces.	•								
	Gramn	nar: Active and p	assive voice,		Describe type of voices and						†
II		and indirect speech.	,	3		type of					1, 2
		[anagement Skills: S]	WOT analysis			Explai	n self-	regula	ationa	nd	1, 2,
III		gulation, personal hy	•	3		person		_	momu	na -	3
		Verbal Communication				Explai					3
		Language: What is N				_					
	•	~ ~				Commi	umcat	1011, 00	ouy iai	nguage	
		unication & Body La									1.0
IV		nts of Communicatio	• •	3							1, 2,
	-	Language, Importanc	-								3,
	-	Language, Types of O									
	•	h Body Language,Bo									
		nd Don'ts, Doubt C									
	_	Discussion (Theory)	-			Develo	•	wledg	ge on	group	
T 7	Plannii	ng, elements ad skills	s assessed;	discussion.						1.2	
V	effectiv	ve disagreeing, sum	marizing and	3							1,2,
	attainir	ng the objective.									

T1: What Employers Want: The Work skills Handbook- Karen Holmes.

T2: English Grammar in Use, Raymond Murphy 4th edition, CUP.

REFERENCE BOOKS:

R1: Professional Communication, by Dr. Prachi Dr. S. K. Singh.

R2: Word Power Made Easy, Norman Lewis, 15 March.

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped ProgramOutcome						
1	Practice of grammar will strengthen their speaking and writing skills.	5, 7						
2	Learners will be able to use the skills in their professional communication.	5, 7						
3	It will enable to deal with thoughts, and emotions in a productive way.	5, 7						
4	The different attributes will develop the students' ability to cope up in professional environment.	5, 7, 8						
5	Train students in planning and conducting group discussions, effectively disagreeing, and summarizing to attain objectives.	3,4,7,8						

		SEME	STER – III											
Course Ti	tle	Ba	sic Financial	Literac	y									
Course co	de	24UUFL211R Total	credits: 1		L	T	P	S	R	O/F	C			
		Total	hours:30P		0	0	2	0	0	0	1			
Pre-requis	site	Nil C	o-requisite					Ni	l					
Programn	ne	Bachelor (f Science in I	Forensi	e Sci	ence	•							
Semester		Fall/ 3rd semes	ter of second	year of	the	prog	grai	n						
Course		To create awareness among students about the need for possessing financial literacy												
Objectives	S	education.												
		2. Identification of money as a wor	king asset.											
		3. Impart the ability to make better	financial dec	isions										
CO1		The students would be able to u	inderstand the	e impor	tanc	e of	fin	ancia	1 K	(now	owledge			
		and prepare financial plans and bud	-			_								
CO2		The students would be able to und		ed and v	vario	us k	ind	of ba	nki	ng				
		institutions' instrument and their ut									_			
CO3		The student would be able to descr	ibe the import	ance of	insu	ranc	e se	rvices	as	socia	ıl			
~		security measures.	.1				20							
CO4		The student would be able to mana												
CO5		Students will learn how to asse	ss and comp	are diff	eren	t ın	vest	ment	op	otions	to			
TI MAI		make informed financial decisions.	T G + +	T =		<u> </u>					T.7T			
Unit-No.		Content	Contact	Learning Outcome							KL			
	Last	roduction:	Hour	Defin	· C		.1 1:4			1				
				Define its imp						a	ļ			
		Meaning, need and importance of		1 -			_							
		Financial Literacy;			finance management and Identify components such as									
		Different components of Financial		savings, investments, financial										
		Literacy;		institutions, and investment										
т		Prerequisites of financial literacy;		avenues.						1.2				
I		Savings – Meaning and Difference	6	avena	C 5.						1,2			
		between savings and investment;												
		Types of Financial Institutions and he services provided- Banking and												
		Non-Banking;												
		Different investment avenues.												
	• 1	omerent investment avenues.												
	Fir	nancial Planning		Explai	in th	e sin	nifi	cance	of					
		Ieaning, need and importance for		financ		_			O1					
		nancial planning,		achiev	_		_		ls a	nd				
		udgeting and its importance in		unders	_			_		ara				
		nancial planning;		tool fo			_	-		nd				
		Steps to involved in Financial		expens										
II		lanning Process;	6	1							1,2,3			
		reparation of personal budgets,									1,2,0			
		udget surplus and budget deficit,												
		venues for savings from surplus,												
		ources for meeting deficit.												
		nformal Society funds and crowd												
		anding												
			1	l										

III	Banks & Post Office- As financial service provider: • Meaning and evolution of money, • Banks— meaning, types & functions; types of accounts; • Formalities to open various accounts. • Different types of Post Office saving schemes: Recurring deposit, savings, term deposit; NSC; Kisan Vikas Patra; Monthly Income scheme (MIS) Account, • Public Provident Funds (PPF), Senior citizen savings scheme (SCSS), Sukanya Samriddhi Accounts, • Indian Postal Order; International Money transfer service; Forex Services; • Money remittance services; Jansuraksha Scheme	6	Define different types of banks, their functions, and account opening formalities and Understand services like international money transfer, forex, and insurance offered by banks and post offices	1,2,3
IV	 Insurance-As financial service provider: Different types of Risks and their Management, Diversification of risk; Meaning, need and importance of Insurance Pension and retirement policies; Post office life insurance schemes, Postal life insurance and rural postal life insurance. 	6	Identify types of insurance policies such as life insurance and retirement plans and learn about post office insurance schemes like Postal Life Insurance and Rural Postal Life Insurance.	1,2,3,
V	Transformations in Digital Money market: • Various functions & innovative services of Banks; Mobile Banking, NEFT, IMPS, RTGS, • Money transfer, Different types of cards-Debits & Credit, E-Banking, Unified payment interface (UPI), • Credit Scoring- CIBIL, Digital Banking, crypto currency and related transactions,	6	Explore innovative banking services like mobile banking, NEFT, IMPS, RTGS, and digital wallets and understand digital transactions, security measures, and credit scoring systems like CIBIL.	1,2,3, 4,5

- T1: The Young Adult's Guide to Financial Success- HowTo Manage Your Money& Live Better On Less By Edward M. Wolpert
- T2: Financial Freedom with Financial Control by Jagmohan Singh Pen down Press

REFERENCE BOOKS:

- R1: The Richest Man in Babylon (Deluxe Hardbound Edition) by George S. Clason ixia Press Garden City, New York, Ships from and sold by MG BOOKS.
- R2: Financial literacy to financial planning by Dr.Purvi Kothari and Mr. Keyur Mehta Nexus Publications Surat Gujarat

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	The students would be able to understand the importance of financial Knowledge and prepare financial plans and budgets and plan and manage personal finances.	8,9						
2	The students would be able to understand the need and various kind of banking institutions' instrument and their utilities	8,9						
3	The student would be able to describe the importance of insurance services as social security measures.	8,9						
4	The student would be able to manage the money and debt more effectively	8,9						
5	Students will learn how to assess and compare different investment options to make informed financial decisions.	8,9						

			SEME	STER – III	[
Course	Title		В	Basic lifesav	ving	skills								
Course	code	24UULS212R	Total credits	: 1	L	T	P	S	R	O/F	C			
			Total hours:	15T	1	0	0	0	0	0	1			
Pre-rec	uisite	Nil	Co-requi						Vil					
Progra	mme		Bachelor of											
Semest	er	F	'all/ 3rd semes	ter of seco	nd yo	ear of t	he p	rogra	ım					
Course		1. To learn and demonstrate essential Basic Life Support (BLS) techniques for assisting in												
Object	ives	medical emergen	-		_									
		2. To enhance comr			l con	flict res	oluti	on sk	ills to	improv	/e			
		personal and pro												
			3. To Understand the Triage system, recognize different levels of triage, and classify common medical emergencies to prioritize patient care effectively.											
				-										
CC) 1	Demonstrate knowle	-	o perform (CPR	use an	AEI), and	l resp	ond to	choking			
			adults and children.											
CC			Inderstand the significance of communication and teamwork in various situations.											
CC			pply knowledge and skill about pre-hospital care and management of trauma emergencies.											
CC		Understand the princ						ealtho	are se	ettings.				
CC)5	Identify and manage	common medic			ondition	ıs.							
Unit-No	٠-	Content		Contact		Le	KL							
				Hour										
	1	c Life Support (BLS			Introdu									
		roduction of BLS			support									
-		ain of survival	_	- 1	surviva		ferent	asses	ssment					
I		BCs Assessment	3	1	techniqu	ues.				1,2				
		R and Ventilation												
		chnique												
		ED - Choking for adul- skills	and children		1	Illustrat	di	ffaman	.+					
		roduction				commu								
		mmunications Skills				situatio								
II		uational Skills		3		ncludir					1,2,3			
		am Work				meraan	15 10.	<i>a</i> 1111 * * C	11.					
		her Soft Skills												
	Trai	ıma emergencies]	Explain	ıs	about	di	fferent				
		troduction				rauma		nerge		and				
		riorities of Initial appr	oach in pre-		1	nethod		_		rauma				
	ho	ospital care	-		6	emergei	ncies							
	c) So	cene safety												
	d) Pı	imary assessment												
Ш	e) Bl	leeding control	3							1,2,3				
111	f) H	elmet removal	Č							1,2,5				
		are of amputated body												
		trication of victims as												
	i) Co	ervical spine stabiliza	ion											
		ervical collar applicat Splinting of broken Li												

IV	 Triage system Introduction Flow chart approach of Triage Triage of Multiple Casualties in Pre-Hospital setting Triage of Single casualty 	3	Illustrates the triage system and explains about multiple causality operations.	1,2,3,
V	 Medical emergencies Introduction Victim centred approach in medical emergency Management of :- a) Seizures b) heart attack c) asthma d) diabetic emergencies e) emergency childbirth f) stroke recovery position 	3	Describes different types of medical emergencies and its management.	1,2,3, 4,5

T1: Nancy Caroline'S Emergency Care in the streets Seventh edition by Jones and Bartlett

T2: First Aid book by LC Gupta

T3: Advance Cardiovascular life support and Basic life support provider manual @ American Heart Association(AHA).

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Demonstrate knowledge and skill to perform CPR use an AED, and respond to choking in adults and children.	4, 5,7,8,9						
2	Understand the significance of communication and teamwork in various situations.	4, 5,7,8,9						
3	Apply knowledge and skill about pre-hospital care and management of trauma emergencies.	4, 5,7,8,9						
4	Understand the principles and purpose of the Triage system in healthcare settings.	4, 5,7,8,9						
5	Identify and manage common medical emergency conditions.	4, 5,7,8,9						

			SEMESTE	R – III								
Course Ti	tle	Chemistry- 3										
Course co	de	24FSCH216R	Total credits: 3		L	T	P	S	R	O/F	C	
			Total hours: 30T		2	0	2	0	0	0	3	
Pre-requi		Nil	Co-requisite					Nil				
Programm	ne		Bachelor of So									
Semester			Fall/ 3rd semester									
Course			a comprehensive		~					ctions,	and	
Objective	S	_	mechanisms of alco	_				_		1		
		_	iency in Werner's				-					
			field theory, and ma	_						_		
			dynamic principles, e gas expansion scer		-		_	-		, work	, and	
			e gas expansion scer ne fundamental pr			•				of vo	rious	
			techniques, includi	-								
			ion, Mass, and X-ray	_			iiiaicc	, 1110	, iiiic	<i>1</i> 10301 j	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
			ency in chemical k	•	•		ate la	ws. fa	etors	influe	ncing	
		_	order, molecularity,			_					5	
			gain knowledge ab							nd che	mical	
CO1			gen containing organ	•								
			their named reaction	_						ŕ		
CO2		Explanation on how to write the nomenclature of co-ordination compounds.										
		Understand the difference between valence bond theory and crystal field theory. The										
CO3		spectroscopic splitting as well as magnetic properties, orgel diagrams related to crystal										
		field theory.										
		Discuss the concepts of thermodynamic fundamentals before studying their application										
CO4		in applied thermodynamics. The understanding of thermodynamic properties and										
		processes will assist them in other related coursework.										
~~-		Understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured. Determine rate law of chemical										
CO5				an be me	easure	ed. De	termıı	ne rate	law	of chei	nıcal	
TT *4		change based on o	•	<u> </u>	4	т	•	0 4			171	
Unit- No.		Conte	nt	Contac Hour		Lea	arnın	g Out	come		KL	
110.	Ovv	gen containing orga	nic compounds	nour		nalyz	e nror	ortios	and			
		ohols, Phenols, Eth				eaction						
		nods of formation a	_			henol						
		ions of Monohydri				poxide		15, 411	•			
		dric Alcohols (vici				Politic	-2.					
		ative cleavage with	• ,									
		4] and Pinacol-Pina	- '									
	rearr	angement. methods	s of formation and									
I	chen	nical reactions of g	ycerol.								1.2	
1	Prep	aration of Phenols,	physical properties	10							1,2	
	and a	acidic character. Co	omparative acidic									
		gths of alcohols an	-									
		nanace stabilization	•									
		•	ctrophilic aromatic									
		ititution, acylation	· · · · · · · · · · · · · · · · · · ·									
		hanisms of Fries re										
		erman synthesis, H										
	react	ion. Lederer-Mian	asse reaction and									

	Reimer-Tiemann reaction. Methods of formation, physical properties, Chemical reactions of Ethers (cleavage and autooxidation, Ziesel's Method). Synthesis of epoxide, acid and base catalyzed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide. Coordination compounds- Werner's		Understand coordination	
II	coordination theory, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.	8	compounds' theory, nomenclature, and isomerism	1,2
III	Metal ligand bonding in Transition metal complexes- Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters. Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μs and μeff values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1and d9 states, discussion of electronic spectrum of [Ti (H2 O)6]3+ complexion.	10	Apply crystal field theory to transition metal complexes.	1,2
IV	Thermodynamics-I: (15 hrs)- Definition of thermodynamics terms: system, surroundings etc. Types of systems, First Law of Thermodynimcs: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.	10	Use thermodynamics to calculate energy changes in gases.	1,2

V	Chemical Kinetics:- Rate of a reaction, rate law & rate constant, factors influencing the rate of a reaction, Units of rate constant, order & molecularity of reactions, zero order, first order, second order half life time of a reaction, methods of determining order of a reaction.	7	Study reaction rates, orders, and mechanisms.	1,2
Practical	 Preparation and Properties of Organic Compounds Analysis of Coordination Compounds. Magnetic and Spectral Properties of Metal Complexes. Determination of heat capacity and Joule-Thomson coefficient. Determination of the rate constant for reactions of zero, first, and second order 	30		1,2,3,

T1: Organic Chemsitry, Paula Yurkanis Bruice, 8th Edition, Pearson.

T2: Stereochemistry of Organic Compounds Principles and Applications, D. Nasipuri, 4th Edition, New Age International Publishers.

T3: Physical Chemistry, Puri Sharma Pathania, Vishal Publishing Co.

T4: Inorganic Chemistry, J. D. Lee. Concise, 5 th Edition, Oxford.

REFERENCE BOOKS:

R1: Organic Chemsitry, Jonathan Clayden, Nick Greeves and Stuart Warren, 2nd Edition (South Asia Edition), Oxford.

R2: Physical Chemistry, Gurdeep Raj, Krishna Prakashan Media (P) Ltd.

R3: Shriver & Atkins Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Michael Hagerman, Oxford.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand and gain knowledge about synthesis, physical properties and chemical reactions of oxygen containing organic compounds such as alcohols, phenols, ethers and epoxides and their named reactions.	1
2	Explanation on how to write the nomenclature of co-ordination compounds.	1
3	Understand the difference between valence bond theory and crystal field theory. The spectroscopic splitting as well as magnetic properties, orgel diagrams related to crystal field theory	1
4	Discuss the concepts of thermodynamic fundamentals before studying their application in applied thermodynamics. The understanding of thermodynamic properties and processes will assist them in other related coursework.	1
5	Understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured. Determine rate law of chemical change based on experimental data.	1

			SEMESTER – I	<u> </u>								
Course	Title		Phys	ics- 3								
Course	code	24FSPH217R	Total credits: 3		L	T	P	S	R	O/F	C	
			Total hours: 30T + 30F	•	2	0	2	0	0	0	3	
Pre-req	uisite	Nil	Co-requisite					Nil				
Progran	nme		Bachelor of Science									
Semeste	er		Fall/ 3rd semester of sec	ond yea	ar of	the p	rogr	am				
Course			ave motion concepts inclu-	ding wa	ive ty	pes, v	veloc	ities, a	and ii	ntensit	y	
Objectiv	ve	based on inver	-									
		2. Explore the electromagnetic nature of light and apply principles like Huygens and										
		Fermat's to wa										
			erence, diffraction, and po	larizati	on pl	nenon	nena,	inclu	ding l	Newto	n's	
		rings and Brev										
			algebra to solve physics p	roblems	s inv	olvıng	g Her	mıtıar	ı, unı	tary, a	nd	
		orthogonal ma					1 1	. ,				
			ntial equations and field	concep	ts to	mod	el pr	iysical	l sysi	tems,	usıng	
	11		nctions and error analysis.	on -4: -	no+-	o cf1.	~1-+					
CO			ncept of waves, electroma				_	- ot-				
		·	pt of vibration like free, da		Torce	VIDI	ations	seic				
CO			een wave optics and ray o		o.m. a o.	tion						
CO		Discuss the concept of interference, diffraction, polarisation Illustration of matrices and their properties, differential equations and their methods of										
	5	solutions									01	
Unit-		Con	tant	Conta	net	Ιο	arnii	ıg Ou	tcom	10	KL	
No.		Con	tent	Hou		LC	a1 IIII	ig Ou	ttom		KL	
110.	Wave	and Oscillations: w	vave motion: plane and	1100	1	Class	sify a	nd an	alvze			
		ical waves, longitud	•			wave	-		ary Z.C			
	•	s, plane progressive				wave	, typt					
		equation, particle a	•									
_		sity of wave, inverse		_								
I		romagnetic nature o	6 1,							1,2		
		rties of wave front,										
		oral and spatial cohe										
	princi	ple and its applicati	on in establishing laws									
	of ref	lection and refraction	n.									
	Interf	erence of Light, cor	dition of sustained			Expl	ain li	ght's '	wave			
	interf	erence by analytical	treatment, theory of			prope	erties					
		~	ation of wavelength and									
II		•	wton ring apparatus.	6							1,2	
		_	nel and Fraunhofer class								1,2	
			at straight edge, circular									
	_		raction at single slit,									
	_	diffraction grating				G: 1	• .	<u> </u>				
		zation of light and				-		rferer		.		
111	_	sentation, production	Δ.		dittra	actioi	ı, pola	ırızat	ion	1.2		
III	_		nd scattering. Huygen's	8							1,2	
	refrac	-	Brewster's law, double									
	L		Zuomamo a o ti		_	I I~ -		vr 41				
137	•	erties of matrices, T	•	_				x theo	ry in		1.2	
IV	_	ial square matrix, u	ix, Hermitian matrix,	5		physi	ics				1,2	
	spec	iai squaie matrix, ui	iii iiiau ix, uiagoilai									

symmetric matrix, anti-symmetric matrix, unitary matrix, orthogonal matrix, trace of a matrix, inverse matrix, rank of a matrix. Eigen value problems.	
matrix, inverse matrix, rank of a matrix. Eigen	
value problems	
value problems.	
Concepts of scalar and vector field, concepts of Apply fields and	
divergent and curl, First Order and Second differential equations.	
V Order Differential equations, solutions to partial	1,2
differential equations, using separation of 5	1,2
variables, definition and properties of Dirac	
delta function, Systematic and Random Errors	
1. Experiment to study the intensity of sound or	
light and verify the inverse square law	
2. Use of a slinky or ripple tank to demonstrate	
and analyze longitudinal and transverse wave	
motion	
3. Measure the velocity of a wave on a string or	
in a medium using a frequency generator and	
tension adjustment	1,2,
Practical 4. Analysis of wave motion using a digital 30	3,4
oscilloscope and function generator to	
simulate plane waves.	
5. Experimental determination of Brewster's	
angle for glass and calculation of the	
refractive index.	
6. Demonstration of wavefronts in a ripple tank	
to validate Huygens' principle	

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand the concept of waves, electromagnetic nature of	1
1	light.	1
2	Discuss the concept of vibration like free, damped, force	1
	vibrations etc.	1
3	Differentiate between wave optics and ray optics	1
4	Discuss the concept of interference, diffraction, polarisation.	1
5	Illustration of matrices and their properties, differential	1
3	equations and their methods of solutions.	1

		SEN	MESTER – III										
Course Ti			Biology				_	1 -	- ·	T =			
Course co	de 24FSBO218R	Total credi		L T P S R O/F						C			
	A. 3747		s: 30T + 30P							0 3			
Pre-requis			Co-requisite Nil chelor of Science in Forensic Science										
Programn	ne e												
Semester	1 771		emester of secon				ram						
Course			eate student on co		torest	ry							
Objectives			st dendrology, for		£				.41 4	C4			
		Turtner deals	s with physiology	of forest	, iore	est m	ıanaş	gemei	nt and 1	ioresi			
CO1	pathology	istory and has	sic concept of For	ractru									
CO2			nd knowledge of		ct								
CO3			s and forest mana		<u> </u>								
CO4)			gement									
CO5			hology, causes of	forest dise	eases								
Unit-No.	Content	are rerest pair	Contact	Lear		Out	com	ıe.	K	$\overline{\mathbf{L}}$			
	Content		Hour			Jul			1				
I	Introduction Forestry:	History of		History,	types	and	poli	cies	1	,2			
	forestry, Classification			of forest.			•			•			
	Basic concepts on for	est types of											
	India. Important acts a												
	related to Indian Forest												
	Forest management:		6										
	and scope of forest m												
	principle of forest r	nanagement											
TT	and their applications.						1		1	2			
II	C ,	*		Importan					1	,2			
	dendrology. Role of			morpholo forest and									
	morphology in ident			101CSt all	u Lcc	noui	15111.						
	woody forest flora	incation of											
	Ecotourism: Defini	tion and	6										
	elements of ecotourism	n, Principles											
	and objectives of												
	Potential of ecotourism	in India.											
III	Plant Physiology: Intr			Importan					1	,2			
	tree physiology, Pho		8	physiolo	gy in	relat	tion	to					
	Water relation of f			forestry									
	transpiration from fore												
	environmental effects and development.	on growth											
IV	Forest Ecology and	Diversity		Importan	ice	of		forest	. 1	,2			
1 4	Forest types of Inc			ecosyste		bio		and		,_			
		nd biotic		abiotic	- ,	510		wiid					
	components and their		5		ents a	and f	ores	t	7				
	Nutrient cycling,		_	Components and forest management and									
	management.	Conservation		ecotouris									
	measurement of	diversity,											
	diversity hot spots, I	Principle of											
	conservation.			D • • •	~ -								
V	Forest Pathology: Im		_	Principle					1	,2			
	forest pathology. Pr		5	patholog			ot to	rest					
	forest pathology, caus			diseases		oiant							
	diseases-Physiological	and		quarantir	ie.								
	pathological, general s												
	forest tree disease,	control of											

	forest diseases, plant quarantine		
Practical	1. Study of vegetation of the	30	
	university campus.		
	2. Study of ecological		
	modifications of leaves		l
	3. Study of woody flora of:		l
	Magnoliaceae and Leguminosae		
	4. Techniques of preparing		
	herbarium specimens.		
	5. Estimation of leaf area of		
	plants		

T1: Agarwal, W.P. Forests in India. Oxford and I.B.H

T2: Arvind Kumar. Biodiversity and environment. A.P.M. Publishing Corporation, New Delhi

T3: Kumar and Asija. Biodiversity - Principles and conservation. Updesh Purohit, Agrobios, Jodhpur

REFERENCE BOOKS:

R1: Raghavendra AS. Physiology of Trees.

R2: John Wiley & Sons. Taiz, L. and Zeiger, E. Plant Physiology 4 th Ed. Sinauer Associates Inc. Publishers, Sunderland.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped ProgramOutcome							
1	Articulate the history and basic concept of Forestry.	1							
2	Importance of Dendrology and knowledge of wood forest.	1							
3	Understanding of forest types and forest management	1							
4	Importance of physiology in forestry.	1							
5	Understanding the forest pathology, causes of forest diseases.	1							

G		I	SEMESTER – I										
Course Ti		2.4DCEC221D		c Biology	T D			0/E					
Course co	ae	24BSFS221R	Total credits: 4 Total hours: 45T+30l	$\frac{L}{3}$	T P 0 2	S	R 0	O/F		<u>C</u>			
Pre-requi	cito	Nil	Co-requisite	3	0 2	0 Nil		0		4			
Programm		INII	Bachelor of Science	e in Foren	sic Scien								
Semester	IIC	Winter/IV Semester of Second year of the programme											
Course			fundamentals of fibre ex					ion, tra	ınsi	fer.			
Objective	S	and persistence.		, ,									
			iency in fibre recover			rime s	cenes	and i	n	the			
			nasizing contamination p										
			in fibre identification	n and co	mparison	throu	ıgh n	nicrosc	opi	cal			
			l instrumental analysis.	1			1			.:			
			examination, covering nd variations among diff				pnas	ses, s	pec	nes			
			edge of wildlife forens				e iden	tificati	on	of			
			dangered species, Pug n							0.1			
CO1		Identify various typ				•							
CO2		Apply effective fil	ore recovery methods in	crime sce	enes and	labora	tories,	preve	ntir	ng			
			g with their practical as				ĺ	-		_			
CO3			lence to identify specie		lerstand	variatio	ns an	nong r	naj	or			
			along with their practica						•				
CO4			eiency in wildlife forens		es, inclu	ding th	e iden	tification	on	of			
				ethods along with their practical aspects.									
CO5			Apply forensic entomology principles to assess the time since death, understand insect										
		'	e of entomotoxicology										
		practical aspects.	<i></i>		·								
Unit-		Cont	ent	Contact	Lea	rning (Outco	me	ŀ	KL			
No.	T .	1 .: 01 :6		Hour	Proficie								
			ion, Fibre transfer and										
	_		very: At the scene, in		fibres, considering classification, transfer,								
		laboratory, contamin											
_		vention. Fibre Identif		8	and persistence, utilizing microscopical and								
I		nparison: Microscopi		-				1,2					
		-	properties, Refractive		echnic	lues.							
		~	strumental analysis, dye										
		•	affecting the strength										
		ibre evidence.			TT 1	4 1.1	•	4-	-				
			hases of hair, species		Unders			icture,					
		ntification, variation			growth	_		t					
II	pop	ulation groups, soma	uc origin	7	variatio				1	1,2			
					populat			g					
					accurat	_							
	T.a.t.	advation immediate	Wildlife (Ducksatian)		identifi				-				
			e, Wildlife (Protection)		Identify								
		-	endangered species of		method								
			ntification of wild life ur, bones, nails, horn,		materia		_						
III				10	protect	_		ug	1,2				
		h, plants, plant parts	•		marks,			i.o					
		ventional and moder	· ·		techniq			IC					
			rks of various animals,		investig	gations	3						
		A techniques in wild	-		A 1		10 = : -	.1	-				
IV	ıntr	oduction, general en	tomology and	10	Apply	entomo	nogica	11	1	1,2			

			I	
	arthropod biology, insects of forensic		principles to determine	
	importance, collection of entomological		time since death, assess	
	evidence during death investigations, the role		insect succession, and	
	of aquatic insects in forensic investigations,		understand	
	Insect succession on carrion and its		entomotoxicology's role	
	relationship to determine time since death,		in forensic investigations	
	factors influencing insect succession on			
	carrion, its application to Forensic			
	Entomology, Entomotoxicology: Insects as			
	toxicological indicators, impact of drugs and			
	toxins on insect development, molecular			
	methods for forensic entomology.			
	Type of wood, leaves, pollens and their		Evaluate and apply	
	identification and comparison.		botanical evidence	
	Diatoms: Nature, location, structure,		analysis, including wood	
V	extraction from various body tissues including	10	identification, leaf	1,2
	bone marrow, preparation of slides, methods		anatomy, and pollen	
	of identification and comparison, forensic		structure, for forensic	
	significance		significance.	
	1) To examine hair morphology and determine			
	the species to which the hair belongs.			
	2) To prepare slides of scale pattern of human			
	hair. 3) To examine human hair for cortex and			
	medulla.			
	4) To carry out microscopic examination of			
	pollen grains.	20		1,2,
Practical	5) To carry out microscopic examination of	30		3,4
	diatoms.			
	6) To cite a crime case in which diatoms have			
	served as forensic evidence.			
	7) To prepare a case report on forensic entomology.			
	8) To prepare a case report on problems of			
	wildlife forensics.			

T1: R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey.

REFERENCE BOOKS:

- R1: W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton.
- R2: G.T. Duncan and M.I. Tracey in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.

- R3: T. Bevel and R.M. Gardner, *Bloodstain Pattern Analysis*, 3rd Edition, CRC Press, Boca Raton. R4: J.M. Butler, *Forensic DNA Typing*, Elsevier, Burlington. R5: K. Inman and N. Rudin, *An Introduction to Forensic DNA Analysis*, CRC Press, Boca Raton. R6: H. Coleman and E. Swenson, *DNA in the Courtroom: A Trial Watcher's Guide*, GeneLex Corporation, Washington.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Identify various types of fibres.	1
2	Apply effective fibre recovery methods in crime scenes and laboratories, preventing contamination along with their practical aspects.	1, 3
3	Examine hair evidence to identify species and understand variations among major population groups along with their practical aspects	1, 3, 8
4	Demonstrate proficiency in wildlife forensic techniques, including the identification of protected species and the use of DNA methods along with their practical aspects.	1, 3, 8
5	Apply forensic entomology principles to assess the time since death, understand insect succession, and use of entomotoxicology in forensic investigations along with their practical aspects.	1, 8

SEMESTER – IV															
Course Ti				rensic Che	mistı										
Course co	de	24BSFS222R	Total credits: 4		L	T	P	S	R	O/F	C				
			Total hours: 45		3	0	2	0	0	0	4				
Pre-requi		Nil	Co-requi					Ni	<u> </u>						
Programi	ne		Bachelor of												
Semester			nter/IV Semester												
Course		1. Introduce stud			rcoti	cs, a	nd ps	sychot	ropic	substa	inces,				
Objective	S		effects on driving.												
		2. Familiarize stu						ood, t	ırıne,	and tis	ssues,				
		U 1	t-mortem changes	_				1			1.				
		3. Explore types a								s, incen	idiary				
		4. Provide knowle	rensic analysis of t							1 cycto	matic				
			explosive residues		xpios	1011 10	COHSI	Tuctio	n, and	ı syste	manc				
		5. Cover analysis			ountr	v-mac	le lia	llor	illicit	liguor	and				
			arations containin												
		bribe trap cases		6 , .											
CO1		Identify and under		ug categorie	es, th	neir in	npact.	and	their	relevan	ice in				
		forensic investigati					• ′								
CO2		Discuss various la	boratory examina	ition for dr	ug de	etectio	n in	forens	sic co	ntexts	along				
		with their practical									-				
CO3		Develop expertise				allowi	ng sti	udents	to de	etermin	e fire				
		origin and causes a								-					
CO4		Analyze and interpret evidence related to explosives, contributing to forensic													
005		investigations. Conduct forensic analysis on beverages and identify relevant substances in forensic													
CO5		scenarios along with their practical aspects.								rensic					
Unit-		Conten		Contact							KL				
No.		Conten	ı	Hour		Lea	11 111113	z Outo	come		KL				
	Des	igner drugs, Narcoti	cs, depressants,		Uno	dersta	nd the	class	ificati	on,					
		ulants, hallucinoger			effe	ects, a	nd im	plicati	ons o	f					
I		gs, club drugs and da	ite rape drugs,	8	various substances on driving,						1,2				
1	drug	gs and driving	0	fostering a comprehensive						1,2					
					understanding of their forensic										
	ъ	1 1: 11 1	/ · /1 · 1 · 1		_	nificar			· C						
		gs detected in blood	•					ry tes							
II	l	nes, post-mortem cha analysis of clandesti	7				s in di ples, a			1,2					
11		ratories, drug abuse		/	1	_				issues	1,2				
	1400	ratories, drug abuse	iii sports					abuse		I					
	Tvn	es of Fires, and Cau	ses of fire.					cident							
		erns of fire Thermoo			1	•		es, ca		nd					
III		elerants and incendi	•	10	1	-		onduc		I	1.2				
1111	Fore	ensic Analysis of Fir	e Debris by	10	ana	lysis o	of fire	debri	s and		1,2				
	l	rumental methods Fe	orensic Analysis							easing					
	_	etroleum products			_			e inve		ons.					
		oduction, classificat			1		•	sives,							
		nistry of explosives			1			IED ty	pes, a	ind					
		EDs and their recons			1	duct s	•								
137		chanism of explosion		10	1			of expl		and	1.2				
IV		cts Systematic exam osive and explosion		10	1		_	gh che chniq		anu	1,2				
		anic and inorganic)						ciency							
		rumental techniques						stigati							
		rpretation			p		,	5 1							
		lysis of alcoholic be	verages, country		Der	nonst	rate sl	cills ir	the						
V		e liquor, illicit liquo		10				oholic		ages,	1,2				
						-				~ /					

	preparations containing alcohol as constituents. Examination of chemicals used in bribe trap cases		country-made liquor, illicit liquor, and chemicals used in bribe trap cases, showcasing expertise in beverage analysis and relevant forensic examinations.	
Practical	 Analysis of alcoholic liquors. Determination of methanol and ethanol in alcoholic liquors. Analysis of gasoline Analysis of explosion residues Systematic identification of (opiates, cannabis, barbiturates, benzodiazepines, amphetamines etc.) Thin layer chromatographic analysis of drugs UV/Vis spectrophotometric analysis of barbiturates, benzodiazepine and amphetamines. 	30		1,2,3

T1: Forensic Chemistry by S bell.

REFERENCE BOOKS:

R1: Criminalistics by R. Safferstein published by Wiley

R2: V.V Pillay, Textbook of forensic medicine and Toxicology, 16th Edition, Paras publications

R3: Pascal Kintz, Toxicological Aspects of Drug-Facilitated Crimes, Academic Press, Elsevier

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms\

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Identify and understand various drug categories, their impact, and their relevance in forensic investigations along with their practical aspects.	1,3					
2	Discuss various laboratory examination for drug detection in forensic contexts along with their practical aspects.	1, 3					
3	Develop expertise in fire-related forensic analysis, allowing students to determine fire origin and causes along with their practical aspects	1, 2, 3					
4	Analyze and interpret evidence related to explosives, contributing to forensic investigations	1, 2, 3, 8					
5	Conduct forensic analysis on beverages and identify relevant substances in forensic scenarios along with their practical aspects.	1, 3, 8					

SEMESTER – IV													
Course Ti	itle		For	ensic Antl	hropo	logy							
Course co	de	24BSFS223R	Total credits:		L	T	P	S	R	O/F	C		
			Total hours: 4		3	0	2	0	0	0	4		
Pre-requi		Nil	1										
Programm	ne	Bachelor of Science in Forensic Science											
Semester			nter/IV Semeste										
Course		1. Understand the definition, scope, and application of Forensic Anthropology, with a											
Objective	S	focus on the study of the human skeleton.											
		2.Learn the nature,								nes, w	ith an		
		emphasis on estir											
		3.Explore the im	-	-	_				tion	1n foi	rensic		
		anthropology, par 4. Master Somatosc	•		•				miaal t	Faatura	a and		
					valioi	1 01 va	Hous	anaioi	ilicai i	icatuic	s and		
		_			dices	for me	easure	ments	of dif	ferent	body		
		_	~	•							-		
CO1			<u> </u>										
					,-,	-,	,			5			
CO2		Apply personal id	entification tech	niques, in	cludir	ıg son	natosc	opy, f	or obs	serving	g and		
		recording anatomic	cal features, scar	rs, occupat	ional	marks	, and	tattoos	s along	g with	their		
		practical aspects.											
CO3		Illustrate Somatometry measurements and interpret indices for various body parts,											
		contributing to per	contributing to personal identification in forensic scenarios along with their practical										
		*											
		Analyze burned bones and bone fragments in mass disasters.											
	ı												
		Content				Lear	ning	Jutco	me		KL		
No.	Def	inition soons and an	mlication of	Hour	Dec	Eaiamt1	** 0.000	rr tlaa	atuder.	o.f			
			•					-	-				
									ne age	',			
I	l			8					c		1.2		
				investigations.							,		
		n skeletal material –				U							
	long	g bones.	_										
	Imp	ortance and need for	r personal		App	ly Son	natosc	opy					
	l	tification, cases that	will require			niques				n			
	_						_						
	l												
		·		_		_					1.0		
l II				7	pers	onal 10	lentifi	cation			1,2		
	l	_	_										
		-											
		_	-										
	l	_	marks, occupational marks and										
			ments of head.		Con	duct S	omato	metrv					
***		, nose, cheek, ear, ha		10		surem		-			1.2		
1111		y weight, height. Ind		10		ces, co			_		1,2		
	inde	ex, nasal index, crani	al index, upper		pers	onal ic	lentifi	cation	, and				
	Fore Hum ident Esti from long Impident pers Som head brid tube physicire Scantatte Som face body	marks for personal 5. Acquire knowled parts, along with Identify human skep practical aspects. Apply personal iderecording anatomic practical aspects. Illustrate Somatom contributing to per aspects. Analyze burned box Utilize facial reconstruction of human language and skeleton. Nature attification of human language and skeletal material—as bones. Tortance and need for attification, cases that sonal identification. Inatoscopy—observated, forehead, eyes, rocage, nasal tip, lips, checked, ear lobes, suprassiognomic ear breadt umference of head, per marks, occupational polymers. The marks of the masure of the marks of the masure of the marks. The marks of the masure of the marks of the masure of the masu	al identification alge of Somatomothe study of burneleton for estimated entification technical features, scannetry measurements and bone franstruction technical features and bone franstruction technical features and stature skull, pelvis, ar personal will require ion of hair on to of nose, nasal in, Darwin's anorbital ridges, the orognathism. I marks and ments of head, and and foot, ices - cephalic	purposes. etry and in ned bones a ation of ag aniques, in rs, occupat ents and i tion in force gments in	race cont investigation of the control of	for mone fra te, sex ag som marks tet ind scenar disaste Lear ficientl an bor stributir stigati duct S suremaces, co	y applies to and stage to for thing of cars, a fine in dentificant and the cars and the cars are	opy, for various one with tattoos one with tattoo one	of difference along the study of the age of	ferent sasters g with serving with body eir pra	the g ar		

	facial index.		study burned bones in mass	
	Study of burned bones and bone		disasters for identity	
	fragments in mass disasters;		establishment	
	Establishment of Partial and Complete			
	identity of skeletal material and dead			
	bodies			
	Facial superimposition techniques,		Utilize facial reconstruction	
	Craniofacial superimposition		techniques, including facial and	
	techniques – photographic		craniofacial superimposition,	
137	superimposition. Facial reconstruction	10	emphasizing tissue depth for	1.2
IV	and its importance. Importance of tissue	10	accurate reconstructions	1,2
	depth in facial reconstruction. Use of			
	somatoscopic and craniometric methods			
	in reconstruction.			
	Development, scope and role of		Understand the role of forensic	
	forensic odontology in mass disaster		odontology, estimate age from	
	and anthropology. Introduction to		teeth, and analyze bite marks,	
	human dentition, structure of teeth,		including their collection,	
	Types and functions of teeth and their		preservation, and forensic	
V	comparative anatomy. Estimation of	10	importance	1,2
	age from teeth.		_	
	Bite Marks: Types of bite marks;			
	collection and preservation and			
	photography of bite mark evidence,			
	forensic importance of bite marks.			
	1) To determine of age from skull and			
	teeth.			
	2) To determine of sex from skull.			
	3) To determine sex from pelvis.			
	4) To study identification and			
	description of bones and their			
	measurements.			
Practical	5) To investigate the differences	30		1,2,3,4
	between animal and human bones.			
	6) To perform somatometric			
	measurements on living subjects.			
	7) To carry out craniometric			
	measurements of human skull.			
	8) To estimate stature from long bone			
	length.			
L				

T1: Boyd, C.C., Forensic Anthroplogy: Theoretical framework and scientific basis.

REFERENCE BOOKS:

R1: Kapoor, A.K., Anthropology and Forensic science

R2: Sehgal, S. Nath, Forensic Anthropology, Science and medicine

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped ProgramOutcome						
1	Identify human skeleton for estimation of age, race, sex, and stature along with their practical aspects.	1, 3						
2	Apply personal identification techniques, including somatoscopy, for observing and recording anatomical features, scars, occupational marks, and tattoos along with their practical aspects.	1, 3						
3	Illustrate Somatometry measurements and interpret indices for various body parts, contributing to personal identification in forensic scenarios along with their practical aspects	1, 8						
4	Analyze burned bones and bone fragments in mass disasters.	1, 3, 8						
5	Utilize facial reconstruction techniques.	1, 3, 8						

	SEM	ESTER – I	V								
Course Tit	Course Title Techno Professional Course- II										
Course co	de 24BSFS224R Total credi	ts:1	L	T	P	S	R	O/F	C		
	Total hour	s: 30P	0	0	2	0	0	0	1		
Pre-requi	site Nil Co-re	quisite	,			Nil		•	•		
Program	ne Bachelo	r of Science	in For	ensic	Scien	ce					
Semester	Winter/IV Sem	ester of Sec	ond ye	ar of t	the pr	ogran	nme				
Course	1. Introduce students to the fun	damental th	neories	of cr	imino	ogy,	includ	ing cla	ssical,		
Objective	s positivist, sociological, and cri	minal anthr	opolog	y pers	pectiv	es.					
	2. Provide knowledge on under	standing mo	odus oj	perand	li, inv	estiga	tive s	trategie	s, and		
	criminal profiling.										
	3. Explore various types of crim		_					_			
	crimes, domestic violence, wh	nite-collar ci	rimes, j	uveni	le deli	nquer	icy, an	d their	social		
	andpsychological impacts.										
	4. Analyze different sensational	crime case s	studies	to unc	lerstar	id real	-world	d applic	ations		
	of criminological concepts.	. 1.1		c	.ı ·	,.		1 1	r 1·		
	5. Educate students on the stru	cture and r	nierarch	iy oi	tne ju	stice	syster	n and	Indian		
CO1	investigative agencies.	i	1		. 1		1 1 1	:			
CO1	Understand and apply various theo										
CO2	Develop investigative strategies an						_				
CO3		nalyze different types of crimes and their social and psychological impacts.									
CO4		Evaluate sensational crime case studies to gain practical insights into criminology.									
CO5		nderstand the structure and hierarchy of the justice system and Indian investigative									
TT *4	agencies.		4 4						TZT		
Unit- No.	Content		ontact Hour	Learning Outcome					KL		
110.	Basics of Criminology: Theories of C		Ioui	Evnl	ain th	e fund	lament	tal			
	classical, positivist, sociological, Crit			_				I			
I	Anthropology, Understanding Modus			theories of criminology and their application in							
1	Operandi, Investigative Strategy, Cris		6	analyzing criminal 1, behaviour.							
	Profiling, Role of Media.										
	Crime: Deviant Behaviour, Hate Crir	nes		Δna	lyze th	e nati	ire and	1			
	Organized Crimes, Public Disorder,	,			•		s type				
II	Domestic Violence and Workplace		6	_			g devia	I			
	Violence,		Ū			-	hite-c	I			
	,			crim					1,2		
	White Collar Crimes, Juvenile					e nati	ire and	1			
	Delinquency, Victimology, SocialCl	nange			•		s type				
III	and Crime, Psychological Disorders	and	6	_			juver	I	1,2		
	Criminality.			delir	nquenc	yand	white	-collar			
				crim	es						
	DIFFERENT SENSATIONAL CR	IME		Eval	uate a	nd lea	rn fro	m			
III	CASE STUDIES: Murder & Killing	gs,	6	sens	ationa	l crim	e case				
1111	POSCO, Rape cases, bizarre identity		0	stud	ies				1,2		
	crimes, criminal defamation, Scandal								- ,-		
	Justice System & Investigative agence	y:		Und	erstan	d and	descri	be the			
	Types of court, Hierarchy of court &			hiera	archy a	and fu	nction	s of			
IV	justice, Introduction to Indian investi	gative	6	the j	ustice	syste	n and	Indian	1,2		
	agency Hierarchy of Different		U	inve	stigati	ve age	encies				
	Investigative agency.										

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Understand and apply various theories of criminology to analyze criminal behaviour.	1, 2, 6						
2	Develop investigative strategies and criminal profiles based on modus operandi.	1, 5, 6						
3	Analyze different types of crimes and their social and psychological impacts.	1, 3,						
4	Evaluate sensational crime case studies to gain practical insights into criminology.	1, 6						
5	Understand the structure and hierarchy of the justice system and Indian investigative agencies.	1, 6						

			SEME	STER -	IV							
Course	Title		-	glish for	emp	loyabi	lity					
Course	code	24UBPD222R	Total credits:	2 Total	L	T	P	S	R	O/F	C	
			hours: 60P		0	0	4	0	0	0	2	
Pre- rec	•	Nil	Co-requis			-		Ni	<u>l</u>			
Program		***	Bachelor									
Semeste Course	er		inter/IV Seme									
Objecti	VOC		 To acquaint students with the various tools of effective presentation. To acquire the speaking skill, instruct, influence, engage, educate, or appeare 									
Objecti	v CS	thelisteners.	speaking skin, i	nstruct,	mmu	cnee, c	ngage,	cauca	w, or ap	opease		
		3. To increase pro	ficiency, preser	nt ability	and	auality	of resu	ıme ar	nd provi	de guida	nce	
		forself- promoti		-					F	8		
		4. To prepare and						walki	ng inter	views.		
CO	1	Enable students to	prepare scripts.	, underst	and 1	nonverl	oal cue	s, ove	rcome f	ear, and		
CO	1	practice public spe	aking strategies	S.								
CO	2	Equip students wit										
CO	3	Teach students the									es.	
CO	4	Prepare students for			ng co	ommon	ly aske	ed que	stions a	nd		
		participating in mo			a .							
CO5 Students will understand the concept of conflict manage					gemen	t, iden	tify diff	erent typ	es,			
Unit-		and analyze its effe	ects.	Contac	.4							
No.		Content		Hour	Learning Outcome KI							
1,00	Publi	c Speaking Skills		110 41	S	tudents	will b	e able	to creat	ie .		
		reparation of Scripts	and		ef	effective speaking scripts, interpret						
	uı	nderstanding Nonve	rbal cues of		ne	nonverbal cues, manage public						
I		ublic Speaking		7	speaking anxiety, and practice effective speaking techniques.					ee	3, 4	
1		nderstanding and O	_	,						s.	3, 4	
		ear of Public Speaki	•									
		ractice strategies of	Public									
	_	peaking	,		0	. 1 .	*11		1 .	. 1		
		ical session on Rest r letter	ime and				_	_	, submi			
		r ieuer paration, submission	& screening		l e	varuate	resum	es and	coveri	eners.		
II	_	Resume.	& screening	5							3	
		ctical session on co	ver letter									
		reening session										
		l Etiquettes			S	tudents	will u	nderst	and the	structure		
III	i. Di	fferent Parts of Ema	il and Usage	5	o	f email:	s and d	raft th	em effe	ctively.	2, 3	
		afting emails effecti	•									
		iew Skills (Mock se	,						commo			
IV		eparing Commonly a	isked	7			_		onfiden	•	3, 5	
		erview Questions			perform well in mock interviews.							
		ock Interview sessio	ns		C	4 1,	vv.:11 -		om al 41.	000000		
		ct Management finition							and the ent, ider	concept		
V		nmuon pe of Conflict Mana	gement	8				-	nalyze i	-	2, 4	
		fects of Conflict Ma	_			ffects.	Jpcs,	and a	y 2.0 1	.00		
L	1/1	and the commentation	5]	

T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

T2: McDowell, Gayle Laakmann.2008.Cracking the Coding Interview (Indian Edition)

REFERENCE BOOKS:

R1: Kannaiyan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi. Dubey, R.C. 2001

OTHER LEARNING RESOURCES:

https://www.aplustopper.com/active-and-passive-voice-rules/https://www.edudose.com/english/direct-and-indirect-speech-rules/

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped ProgramOutcome						
1	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and practice public speaking strategies.	5, 7						
2	Equip students with skills to prepare, submit, and screen resumes and cover letters.	5, 7						
3	Teach students the different parts of an email and effective email drafting techniques.	5, 7, 9						
4	Prepare students for interviews by practicing commonly asked questions and participating in mock interview sessions.	5, 7, 9						
5	Students will understand the concept of conflict management, identify different types, and analyze its effects.	3,4,7,8						

	SEMESTER – IV								
Course Title		Digital I	Literacy						
Course code		Total credits:1	L	T	P	S	R	O/F	C
		Total hours: 30P	0	0	2	0	0	0	1
Pre-requisite	Nil	Co-requisite					lil		
Programme		chelor of Science							
Semester		V Semester of Fir				_			
Course		1. Students will be able to identify and analyze computer hardware, software and							
Objectives	their uses.								
	2. Students will be able to use MS-Office suite for various purposes.								
	3. Students will be able to use the Internet efficiently for required information as well as								
604	for digital financial tran			<u> </u>		1 1			
CO1	Understanding of Compute				_		lıng.		
CO2	Apply MS-Office to solve l		_				4 .4 .	-11	
CO3	Operate the Internet, social				efficier	itly ai	nd ethi	cally.	
CO4	Analyse the cybercrimes or				1	. 1 1		1 1 101	
CO5	Explore the functionality as	nd use of credit car							
Unit-	Content		Contac	t]	Learr	ing O	utcome	KL
No.			Hour						
	Fundamentals of Compu				_			amental	
	Components of a Comput	1		'	of con	iputei	syste	ms.	
	functions. Different Types of Computers								
	and their applications. Lab Experiment:								
I	_	of a Commutan	6						
1	• Identify the Components and their Functions and d	-	U						
	Computers and their App								
	 Demonstrate the usage o 								
	devices and identify varie							1,2	
	system file management								
	Introduction to MS-Offic			-	Descri	be the	e func	tions on	
	of theMS-Office suite. Cr	•			differe		tool		
	documents with MS-Wor			Microsoft Office like MS-Excel, MS- Word,					
	Creating Presentations with								
	PowerPoint., Creating Spre			etc.					
	MS-Excel.								
	Lab Experiment:								
	Demonstrate how a docu	ument to be							
	prepared and formatted	in MS Word.							
***	Create casual application	ns for 3 days							
II	leave because of family	marriage	6						
	ceremony using Word F	Processor.							
	Create a curriculum vita	ae using MS-							
	Word. 4. Creating a tim	e table with							
	MS-Word.								
	 Design PPT on Comput 	-							
	using different effects s								
	Design, Record etc., on		1						
	• Design PPT on Computer	-							
	using different effects su	ch as							

	Transitions, Animations etc., on slides.			
	• Creating the time table with MS-Excel.			
	• Creating the 10 student's Marksheet			
	include total, grade, percentage and			
	results using MS-Excel's formulas			
	Introduction to Internet & Cyber		Explain the importance	
	World:		and use of internet along	
	Introduction to Computer Networks and		with its adverse side.	
	Internet. World Wide Web, Websites and			
	Web portals, Web browsing. Web			
	Searching, Search engines, Introduction to			
	Google Search Engine; How to search			
	using Keywords, topics of Interest, etc.			
Ш	Creation and use of Email Accounts.	6		
	Cyber Crimes.			1,2,3
	Lab Experiments:			
	• Creating a professional Google account			
	and use various products of Google like			
	drive, photos. Study of computer network			
	and internet and demonstrate how to			
	search information using keywords in			
	different search engines.			
	Introduction to social media:		Explain the power of	
	The Power of social media, Relevance of		social media their	
	social media in present scenario.		relevance and adverse	
	Creating accounts and using some		effects to over using it.	
	popular social media portals and Apps			
	like WhatsApp, Facebook, Twitter, Instagram, and LinkedIn. Social Media			
	Etiquettes.			1,2,3,
IV	Lab Experiments:	6		4
	Creating an account of some popular			
	social media portals and Apps like			
	LinkedIn, Facebook, Twitter, and			
	Instagram.			
	Creating an accounts of digital payment gystams like gradit gords, debit gords.			
	systems like credit cards, debit cards, net banking			
	Introduction to Digital Payment Systems.		Illustrate the types of	
	Creating accounts and using Digital		digital payment and their	
	Payment Systems like Credit Cards, Debit		risks.	
	Cards, Net banking, UPI.			
	Lab Experiments:			1.00
V	Create online Google form and learn how	6		1,2,3,
	togive online test.			4,5
	• Creating an account of Online Shopping sites like Amazon, flipkart, eBay etc.			
	Understand the			
	• journey of customer to buy and sell on			
	online shopping sites.			
			<u> </u>	1

 $T1: Sinha\ Pradeep\ K.\ and\ Priti\ Sinha\ "Computer\ Fundamentals:\ Concepts\ Systems\ \&\ Applications"\ 3^{rd}$

Edition

T2: Goel A "Computer Fundamentals" 2010

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Understanding of Computer Hardware, Software and Computer	8,9			
	handling.				
2	Apply MS-Office to solve basic information Management issues.	8,9			
3	Operate the Internet, social media and e-commerce sites	8,9			
	efficiently and ethically.				
4	Analyse the cybercrimes on digital payments application.	8,9			
5	Explore the functionality and use of credit cards, debit cards, net	8,9			
	banking, and UPI.				

SEMESTER – IV												
Cours	Course Title Basic acclimatizing skills											
Course code		24UULS221R	Total credits: 1		L	T	P	S	R	O/F	C	
			Total hours: 15	5 T	1	0	0	0	0	0	1	
Pre-re	quisite	Nil	Co-requisite)		•		1	Vil			
Progr	amme		Bachelor of So									
Semes	ter	Wir	nter/ 4th semester	r of seco	nd ye	ear of	the	progi	am			
Cours	e	1. To impart knowle	edge of the funda	amentals	of I	Hospi	tality	indu	stry a	nd its		
Objectives applications.												
			le to familiarize with the cooking equipment's & Utensils.									
				erent modes of reservations.								
	O 1	Students will have ba		e e e e e e e e e e e e e e e e e e e								
	O2	Students will gain the					-	Room	S.			
	03	Students will be able										
C	04	Students will be able	to acquire the kno	wledge	of ba	sic ho	useh	old's	amen	ities for	day-	
		· ·	to- day use.									
C	05		p an understandı	ding of personal financial management and								
T		budgeting skills.						177				
Unit- No.		Content		Contac Hour		Learning Outcome				ome	KL	
110.	Introd	uction to Accommoda	ation	Hour		Explains the techniques of				ques of		
		gement			accommodation management.							
	1	ohone handling techniq										
	_ ^	ganizing of Rooms.									1.0	
I	_	-	3							1,2		
		ning agents.										
		ning equipment's and u										
		making Process.										
Funda		mentals of Cooking								nentals		
		finition of cookery–Aim & Objectives of				of cooking including effici and safety methods.			emcient			
П	cook	•		3		ana s	arcty	metn	ous.		1,2,3	
	• Use of	of basic Cooking equip	ment's						1,2,5			
	• Perso	onal Hygiene and Safet										
		of Fire & Fuels										
		ds of Cooking							rent	methods		
		erent Cuts.			of cooking.							
III		of Herbs and Spices.	3							1,2,3		
		asic Food and Beverage Preparation.										
		onal food Habits			F 1	•	1 '11					
		ns & Format's				Explains and illustrates						
	• C –fo		3		various formats of writing forms like reservation,							
IV		rvation form						valior	1,	1,2,3,		
-	_	stration form			passp	ωι, ε	ic.			4		
	_	assport Application form Legal Rent										
	Agre	ement										

	Introduction to Accommodation		Explains the techniques of	
	Management		accommodation management.	
	Telephone handling technique			1 2 2
V	Organizing of Rooms.	3		1,2,3,
	Cleaning agents.			4,5
	Cleaning equipment's and uses.			
	Bed making Process.			

T1: Arora K "Theory of cookery" 2011

T2: Bruce H. Axler, Carol A. Litrides "Food and Beverage Service" 2010, Vol-1

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students will have basic knowledge of cooking methods.	9				
2	Students will gain the knowledge of organizing & Cleaning of Rooms.	9				
3	Students will be able to gain the travel management concept.	9				
4	Students will be able to acquire the knowledge of basic household's amenities for day- to-day use.	9				
5	Students will develop an understanding of personal financial management and budgeting skills.	9				

		SEMESTER – IV									
Course Title			Chemistry-		T -		T = T			~	
Course code	e 24FSCH225R	Total credits: 3		T	P	S	R	O/F	_	<u>C</u>	
D	****	Total hours: 30T + 30	0P 2	0	2	0	0	0		3	
Pre-requisit		Co-requisite			- C •	Ni	l				
Programme	<u> </u>	Bachelor of So					0.755				
Semester Course	1. Study synth	Winter/ 4th semeste nesis and reactions of alc				progr	am				
Objectives	1	l properties and reactivit	•			d deriv	zative	• C			
Objectives	I	nodynamic principles an	•	•		a acii	v ati v C				
		nciples of molecular spe									
		aman and electronic spec									
CO1		nd gain knowledge abo									
	I	rbonyl compounds such	as aldehyo	des and	l ketor	nes alc	ong w	ith the	eir n	amed	
COA	reactions.	1 1 1 1 1	4 41	. 1	. 1		, .	1	1	• 1	
CO2		d gain knowledge abo	•		•	• •					
		rboxylic acids and their	derivative	s such	as acı	a chlo	orides	, ester	s, a	mides	
602	and acid anhyd			1 .1				•			
CO3		basic principle of spec			varıou	s spec	ctrosc	opic to	echn	nques	
CO4		ne motion of different me basic principle of spec			Variou	e enac	rtross	onic t	echr	igues	
04		ne motion of different m			variou	s spec	uosc	opic u	CCIII	nques	
CO5		molecular techniques as			nan ar	nd elec	troni	c spec	tros	copy.	
Unit-No.		Content			earnin			_		KL .	
			Hour								
	Aldehydes and Ke	` ′			ain ald	•	and				
		omenclature and structure of the			e reac	tions					
		ynthesis of aldehydes									
	-	particular reference to									
	the synthesis of ale	•									
	chlorides, synthesi	•									
	•	dithianes, synthesis of									
		tes and from carboxylic									
	acids. Physical pro	-									
		eleophillic addition to									
		th particular emphasis									
	of Benzoin, Aldol,										
I	Knoevenagel cond	· ·	10						1	,2	
	Condensation with										
	derivatives, Wittig	greaction, and Mannich									
	reaction.										
	Use of acetals as p	•									
		f aldehydes, Baeyer-									
	Villiger oxidation	of ketones, Cannizzaro									
	reaction, MPV, Cl	emmensen, Wolff-									
	Kishner, LiAIH4 a	and									
	NaBH4reductions	.Halogenation of									
	enolizable ketones	s.									
	An Introduction to	unsaturated aldehydes									
	and ketones, Mich	ael addition.									
				<u> </u>							

II	Carboxylic Acids and derivatives- Nomenclature, structure and bonding. Physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation. Methods of formition and chemical reactions of halo acids. Hydroxyacids, maleic and tartaric acid, citric acids. (Structural Formula only), Methods of formation and chemical reaction of unsaturated nonocarboxylic acids. Dicaboxylic acids, methods of formation and effect of heat and dehydrating agents. Carboxylic Acid Derivatives Structure and nomenclature of acid chlorides, esters.amides and cid anhydrides. Relative stability and reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophillic acyl substitution. Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterfication and hydrolysis (acidic and Basic).	8	Describe carboxylic acid properties	1,2
III	Theromodynamics-II- Second law of thermodynamics: need for the law, Carnot cycle and its efficiency, Carnot theorem. Concept of entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical changes, Entropy change in ideal gases mixing of gases, Some other state functions: Gibb's Function (G) and Helmholtz function (A).	10	Apply thermodynamic laws to reactions	1,2
IV	Spectroscopy: Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom. Rotational Spectrum: Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect. Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic	10	Interpret rotational and vibrational spectra.	1,2

	oscillator, selection rules, pure vibrational			
	spectrum, intensity, determination of			
	force constant and qualitative relation of			
	force constant and bond energies, effect			
	of anharmonic motion and isotope on the			
	spectrum, idea of vibrational frequencies			
	of different functional groups.			
	Raman Spectrum: Concept of		Analyze Raman and	
	polarizability, pure rotational and pure		electronic spectra	
	vibrational Raman spectra of diatomic			
	molecules, selection rules.			
	Electronic Spectrum: Concept of potential			
\mathbf{V}	energy curves for bonding and	7		1,2
	antibonding molecular orbitals,	,		
	qualitative description of selection rules			
	and Franck-Condon principle. Qualitative description of σ , π and n M.O.their			
	energy levels and their respective			
	transitions.			
	1. Perform a nucleophilic addition			
	reaction to synthesize benzoin from			
	benzaldehyde using potassium			
	cyanide as a catalyst.			
	2. Study the Cannizzaro reaction by reacting a non-enolizable aldehyde			
	(e.g., formaldehyde) and determine			
	the products.			
	3. Study the rotational spectrum of a			
Practical	diatomic molecule like HCl or DCl to	30		1,2,3,4
	determine bond length and verify the			
	rigid rotor model.			
	4. Observe Raman spectra of molecules to identify vibrational and rotational			
	transitions., Conduct an experiment			
	using a calorimeter to study heat			
	transfer and efficiency in a Carnot			
	cycle.			

T1: Fundamentals of Organic Chemistry, Solomons, John Wiley.

T2: Principles of Physical chemistry, Puri ,Sharma, Pathania.

REFERENCE BOOKS:

R1: Organic Chemsitry, Morrison and Boyd, Prentice-Hall.

R2: Organic Chemistry. F.A. Carey, McGraw Hill, Inc.

R3: S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped ProgramOutcome			
	Understand and gain knowledge about synthesis, physical				
1	properties and chemical reactions of carbonyl compounds such as	1			
	aldehydes and ketones along with their named reactions.				
	Understand and gain knowledge about synthesis, physical				
2	properties and chemical reactions of carboxylic acids and their	1			
_	derivatives such as acid chlorides, esters, amides and acid	•			
	anhydrides.				
3	Understand the basic principle and laws of thermodynamics	1			
	Understand the basic principle of spectroscopy and the various				
4	spectroscopic techniques used to study the motion of different	1			
	molecular systems				
5	Understand the molecular techniques associated with Raman	1			
3	and electronic spectroscopy.	1			

		SEMESTER – IV									
Course T		4 (FCD) 144 (D)		ics- 4	TD.	Ъ	-		0/5		
Course c	ode	24FSPH226R	Total credits: 3 Total hours: 30T + 30P	L 2	T 0	P 2	<u>S</u>	R 0	0/F 0	<u>C</u>	
Pre-requ	isite	Nil	Co-requisite		U		Nil	U	U		
Program		1 (11	Bachelor of Science	in Forens	ic Scie	nce	1111				
Semester			Winter/ 4th semester of so				ram				
Course				ng of crystalline materials.							
Objectiv	es										
		3. Explore pol	arization, semiconductor	conductiv	ity, an	ıd suj	perco	nduct	ivity		
		principles.									
			nodynamic laws and their								
		•	netic theory, blackbody	y radiatio	n, and	d sta	itistic	al m	echan	ics	
60.	_	concepts									
CO			t crystal structure and phon	ons							
CO2		Discuss about su	• •	nd armana	nducto						
CO3			wledge of semiconductor a		naucto	I					
CO4			ne basics of thermodynamic various quantities related		dvnom	nice	cuch	20 20	tropy	and	
CO.	,	thermodynamic 1	<u>*</u>	to therme	Juymam	nes,	Sucii	as cii	пору	anu	
Unit-			ontent	Contact	Le	arnir	ஏ பெ	tcome	k	ΚL	
No.			ment	Hour	Lee		ig Ou	come		L	
	Amo	rphous and crysta	Illine materials, lattice		Desci	ribe c	rystal	line			
	I		ice with a basis, unit cell,		struct	ture a	nd bo	nding.			
		mic packing fraction, reciprocal lattice, types lattices, Brillouin zones, lattice planes and									
I	I		7						1,2		
		r indices, diffracti g's law types of b									
		Van der Waal's									
	Basic	c idea of lattice vi	bration and phonon,		Expla	ain la	ttice				
			phonons, Einstein and	vibrations and							
	Deby	e theories of spec	ific heat of solids. Dia-,	magnetism							
II			agnetic materials, Curie's	5						1,2	
		Weiss's theory of									
		nagnetisms, magn curve, hysteresis a									
					TT 1.	4	1				
			ility, electric susceptibility,		Unde			nd			
		•	tric polarizability, N type) and insulator.		super						
		,	onductor, mobility, Hall		prope		_	,			
	Effec	•	officially, fram								
III		sner effect, Type-	I and Type_II	8						1,2	
			on's equation and								
		ration depth, isoto									
		y (no derivation):									
	lengtl	n.									
			dynamics and temperature.			-	-	namic	;		
			nergy, Applications of	5	laws	in pr	ocesse	es			
			ation between CP and CV,								
IV		•	and Adiabatic Processes, sible processes, Second law							1,2	
			cycle & theorem, Third								
		A .	s, Unattainability of								
	absol	ute zero.									

V	Derivation of Maxwell's law of distribution of velocities, mean free path (Zeroth Order), Viscosity, Conduction and Diffusion Law of equipartition of energy (no derivation), monoatomic and diatomic gases. Blackbody radiation, Spectral distribution, Planck's law, Wien's distribution law, Rayleigh, Jeans Law, Stefan Boltzmann Law, concept of Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability	5	Analyze kinetic theory and blackbody radiation	1,2
Practical	 Verify Bragg's law by studying the diffraction pattern of X-rays using a crystal (e.g., NaCl). Measure the Hall voltage and determine the carrier type (P or N), carrier concentration, and mobility in a semiconductor sample. Trace the B-H curve for a ferromagnetic material and calculate the energy loss due to hysteresis. Determine the specific heat of a solid using the Debye or Einstein model experimentally. Determine the viscosity of a gas by measuring its flow through a capillary tube. 			1,2, 3,4

T1: Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley and Sons, Inc.

REFERENCE BOOKS:

R1: Gupta and Kumar, Solid state Physics, K. Nath and Co., Meerut, 9th Edition.

R2: Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.

R3: Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, Tata McGraw-Hill.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand about crystal structure and phonons.	1
2	Discuss about superconductivity.	1
3	Illustrate the knowledge of semiconductor and superconductor	1
4	Understanding the basics of thermodynamics	1
5	Describe about various quantities related to thermodynamics,	1
3	such as entropy and thermodynamic potentials.	1

		SEMEST	TER – IV								
Course Titl	e		Biology-	4							
Course code	e 24FSBO227R	Total credits: 3		L	T	P	S	R	0/1	F	C
		Total hours: 30		2	0	2	0	0	0		3
Pre-requisi		Co-requi					Nil				
Programme		Bachelor of									
Semester		Vinter/ 4th semes						m			
Course	1 *	knowledge on diff	1 2	_						+ - i	
Objectives	2. To provide the physiological	e information reg	garding role	01 1	1011110	nes,	enzym	ies in	mam	ıaın	nng
	1 1	knowledge relat	ted to var	ions	func	tions	of	resnii	atory	, aı	nd
	endocrine gla	_	ica to var	1045	Tune	tions	, 01	гозрп	utor y	aı	ii u
CO1	Understand the ph		ovascular aı	nd ex	cretor	V SVS	tem of	huma	an		
CO2	Discuss the mecha	• ••									
CO3	Illustration of ner	_				_			_	-	
CO4	Understand the ba										
CO5	Discuss and classi										
Unit-No.	Conte		Contact				Out			K	L
			Hour				, 0				
I	Cardiovascular Syste of blood, Basic Struc Heart, Origin and cor heartbeat, Cardiac cy Excretory System: No and Functions, Mecha formation, Counter-cy Mechanism	ture of Human aduction of the cle. ephron- Structure anism of Urine	5	phy	dents v vsiolog excre	y of	Cardio	vascu	ılar	I	
п	Respiratory System: I ventilation, Mechanis Transport of respirate Digestive System: Predigestion in the alime Absorption of carbon fats	sm of breathing, ory gases ocess of entary canal;	7	the exc	dents v mecha hange absor	anism , proc	of ga	seous		1	,2
III	Nerve and muscle: St neuron, Resting mem Origin and conductio impulse in myelinated myelinated nerve fibr Introduction to anima animal tissue, sliding	6	Students will know regarding nerve and its impulse propagation and different animal tissues				ing	1	,2		
IV	Reproduction and En Physiology of male re female reproductive s Structure and function glands and their horm	eproductive and system, n of endocrine	5	Students will have basic understanding of human reproductive system and endocrine system.					1	,2	

V	Enzymes: Introduction, Types of enzymes, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation Cell Biology: Overview and Cell division	7	Students will have understanding on enzymes, its mechanism and cell biology.	1,2
Practical	 Study of different bones using disarticulated skeleton of fowl/rabbit Study of different developmental stages of frog using permanent slides. Study of developmental stages of Chick embryo using permanent slides. Preparation of human blood smear and study on morphology of blood cells. Preparation of temporary slides of animal tissues: Epithelial, Skeletal and Cardiac 	30		1,2,3,

- T1: Essentials of Animal Physiology by S. C. Rastogi (Latest Edition) Publisher New Age Internationals.
- T2: Textbook of Medical Physiology by Guyton and Hall (Latest Edition). Elsevier.
- T3: Animal Physiology Edn.5 Part II, Verma (P.S) Etc, Aul. H Ed.Nch (James) Himalaya.
- T4: Chordate Zoology and Animal Physiology, Jordan(El); Verma(P.S), S Chand and Company.
- T5: Introduction to Animal Physiology, Kay(Ian), Bios Scientific Publishers.

REFERENCE BOOKS:

- R1: Eckert Animal Physiology: Mechanisms and Adaptations by Eckert and Randal (4th Edition). W. H. Freeman.
- R2: Animal Physiology by Hill, Wyse and Anderson (3rd Edition). Sinauer Associates, Inc. Publishers Sunderland, Massachusetts.
- R3: Essentials of Medical Physiology by K. Sembulingam and Prema Sembulingam (7th Edition). Jaypee Brothers Medical Pub
- R4: Physiology by Linda S. Costanzo (7th Edition.). Wolters Kluwer
- R5: Animal physiology: mechanism and adaptations by Eckert R. and Randal D (2nd Edition) CBS publishers and Distributor, New Delhi
- R6: General and Comparative physiology by Hoar W. S.(Latest Edition). Prentice Hall of India Pvt. Ltd.

OTHER LEARNING RESOURCES:

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Understand the physiology of Cardiovascular and excretory system of human.	1, 6					
2	Discuss the mechanism of gaseous exchange, process of digestion and absorption.	1, 2					
3	Illustration of nerve and its impulse propagation and different animal tissues	1					
4	Understand the basics of human reproductive system and endocrine system	1, 6					
5	Discuss and classification of enzymes, its mechanism and cell biology.	1					

		SEMESTER – V											
Course T				sic Serol		_	~		0.77				
Course co	ode	24BSFS311R	Total credits: 4		T	P	S	R	O/F	<u>C</u>			
Due ne sur	:a :4 a	Nii	Total hours: 45T+30	0P 3	0	2	0	0	0	4			
Pre-requi Programi		Nil	Co-requisite Bachelor of Scien	ngo in Fo	ronsio	Saion	Ni	L					
Semester	ine		Fall/V Semester of th					Δ					
Course		1. Understand tl					mmunity, and the role of						
Objective	es		enes, and adjuvants in			ica iii	mmam	.t.j., un	ia the	1010 01			
, sajetti.			ypes, physio-chemical			functi	ons o	f imm	unoglo	bulins,			
			e process of raising ant						C				
			forensic significance o		serolo	gical	reage	nts, ar	nd metl	nods of			
			sed in serological work										
			ntigen-antibody react		cluding	g pred	cipita	ion,	aggluti	nation,			
			and immunofluorescen applications and poter		ille of	tha L	II A .	azetan	in no	tornity			
		testing.	applications and poter	illiai pilii	1118 01	the 1	ILA	system	т ш ра	itermity			
COI			system, innate and ac	auired ir	nmuni	tv. and	d the	role o	of antig	gens in			
		forensic contexts.	, ,	1 11		J , 222		\		 - ر			
CO2			chemical properties,	and fir	nction	s of	imm	unoøl	obuling	s, and			
		, , , ,	bility to raise antisera a					_	o c u i i i i	o, una			
CO ₃	ı		orensic settings, utilizing			_		•	in metl	nods of			
		1 1 1	rological work along v	•	_	_		· · · · · ·					
CO4			antigen-antibody read					tion	aooluti	nation			
			immunofluorescence.	ourono, n	ioraan	.6 P.0	orprid	,	4551411	,			
CO5	·	•	ations and potential p	itfalls of	the H	LA sv	stem	in na	ternity	testing			
		scenarios	ations and potential p	itiuiis oi	110 11	Li Sj	Stelli	ın pu	cermity	testing			
Unit-		Conte	ent	Contact		Learn	ing (Dutcoi	me	KL			
No.			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Hour				ucco					
	1	une system, immur	* · ·		Uno	derstan	d the	immu	ne				
		equired immunity	and antigens,		syst	system, innate and acquired							
		enes and adjuvants.	1	immunity, and apply this									
		unoglobulin: Types	raising of antisera.		kno	wledg	e to fo	orensi	С				
		ns: Forensic signifi			scei	narios							
I	1	_	thods of sterilization	8						1,2			
		oyed for serologica											
			tions: Precipitation,										
		tination, compleme	ent, neutralization,										
	1	nofluorescence. system: Its applica	tions in notamity										
	1	g, pitfalls of HLA	1										
		d: Identification (Pr			Der	nonstr	ate nr	oficie	ncy in				
		rmatory tests), spec	-			erstan	_		-				
		unodiffusion and	5			utilizi	_		, 0				
	`		, Individualization:				-	ns for	forens	i			
		d grouping, enzyme				lysis							
		men: Composition,				-)							
II morp (Prel		-	ozoa, Identification	7						1,2			
		iminary and confirm		,						1,2			
		ding Azoospermic	· ·										
		-	l Grouping, seminal										
		isozymes typing.											
		emposition, function	ns and forensic										
		ficance of saliva, sy											
	aigiii	incanice of Saliva, SV	weat, mink, utille,										

	faecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH substances. Introduction- History of DNA Typing,		Apply lectins with an	
III	human genetics- heredity, alleles, mutations and population genetics, molecular biology of DNA, variations and polymorphism in DNA. DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR, Mitochondrial DNA, DNA Barcoding for species identification, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, quality control, certification and accreditation	10	understanding of their forensic significance, buffers, and serological reagents in sterilized conditions	1,2
IV	Applications in disputed paternity cases, child swapping, missing person's identity-civil immigration, wildlife and mass disaster victim identification cases,.	10	Perform and interpret reactions such as precipitation, agglutination, complement, and immunofluorescence in forensic contexts	1,2
V	Legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad, new and future technologies: DNA chips, SNPs and limitations of DNA profiling	10	Analyze the applications and potential pitfalls of the HLA system in paternity testing, considering its forensic significance	1,2
Practical	 To determine blood group from fresh blood samples. To determine blood group from dried blood sample. To carry out the crystal test on a blood sample. To identify blood samples by chemical tests. To identify the given stain as saliva. To identify the given stain as urine. To carry out cross-over electrophoresis. To study the correlation between impact angle and shape of bloodstain. To identify the point of convergence from the bloodstain patterns. 	30		1,2, 3,4

T1: R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey.

REFERENCE BOOKS:

- **R1:** W.G. Eckert and S.H. James, *Interpretation of Bloodstain Evidence at Crime Scenes*, CRC Press, Boca Raton.
- **R2:** G.T. Duncan and M.I. Tracey in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.
- R3: T. Bevel and R.M. Gardner, *Bloodstain Pattern Analysis*, 3rd Edition, CRC Press, Boca Raton.
- R4: J.M. Butler, Forensic DNA Typing, Elsevier, Burlington.
- R5: K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton.
- **R6:** H. Coleman and E. Swenson, *DNA in the Courtroom: A Trial Watcher's Guide*, GeneLex Corporation, Washington.

OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Explain immune system, innate and acquired immunity, and the role of antigens in forensic contexts.	1
2	Classify physio-chemical properties, and functions of immunoglobulins, and demonstrate the ability to raise antisera along with their practical aspects.	1, 3
3	Apply lectins in forensic settings, utilizing serological reagents and explain methods of sterilization for serological work along with their practical aspects	1, 3, 8
4	Interpret various antigen-antibody reactions, including precipitation, agglutination, complement, and immunofluorescence.	1, 3, 8
5	Assess the applications and potential pitfalls of the HLA system in paternity testing scenarios.	1, 8

	SEMESTER – V												
Course Ti	itle		F	orensic To	xicolo	gy							
Course co	de	24BSFS312R	Total credits: 4	ļ	L	T	P	S	R	O/F		C	
			Total hours: 4	5T+30P	3	0	2	0	0	0		4	
Pre-requi	site	Nil	Co-requ	isite				Nil					
Programm	ne	Bachelor of Science in Forensic Science											
Semester			Fall/V Semester	r of third y	ear of	f the p	rogra	mme					
Course		1. Introduce students to poison classification, signs of drug addiction, drug toxicity,											
Objective	S	and methods for extracting poisons from biological specimens.											
		2. Explore pharmacology and toxicology of psychotropic drugs, including sedatives,											
		stimulants, opiates, and drugs of abuse.											
		3. Cover the nat		_	symp	otoms,	and	detect	ion o	of cor	ros	ive	
		· ·	c, mercury, and le										
		4. Explore pestic				and est	timati	on, as	well	as vo	olat	tile	
		_	ethyl alcohol and										
		5. Introduce stude							alysis	, breat	h t	test	
		· ·	d asphyxiants lik										
CO1		Understand the fo		_	_					and ar	ıaly	yze	
~~~		toxic substances in						_					
CO2		Explain the effects of psychotropic drugs and their implications in forensic											
602		investigations along with their practical aspects.  Interpret metallic poison analysis and their medico-legal aspects.											
CO3			•				_		1	. 1			
CO4		Analyze non-vola	•			_		effects	and	contrit	out	ıng	
COF		to forensic investi						:4:	. :	1.		1	
CO5		Analyze miscellaneous poisons contributing to forensic examination in complex and rare cases											
Unit-		Content Contact Learning Outcome KL											
No.		Content		Hour	Learning Outcome KI								
1,00	Clas	sification of poisons	s. drug	11041	Prof	icientl	v ide	ntify, c	lassif	V.	+		
		ction and its signs a	-		1	isolate	•	•		,			
I		toxicity. Extraction		8		onstra			erstan	ding	1	1,2	
	_	oisons from viscera			of drug addiction signs and							,	
	_	gical specimen			ptoms		C						
		macology and toxic	ology of		App	ly kno	wledg	ge of			T		
	Psyc	hotropic Drugs: Sec	latives,		psyc	hotrop	oic dr	ug effe	ects,				
II	Stim	ulants, Opiates and	drugs of abuse.	7	shov	vcasin	g exp	ertise i	in		1	1,2	
					seda	tives,	stimu	lants, o	opiate	s,			
					and	drugs	of abı	ise.					
	Natu	re, administration, s	sign &		Ana	lyze m	etalli	c poiso	ons w	ith			
	symp	otoms, fatal dose, po	ostmortem		expe	ertise i	n dete	ection	metho	ds,			
III	findi	ngs, detection and r	nedicolegal	10	post	mortei	n fino	lings,	and		]	1,2	
	aspe	cts of-Corrosive poi	sons: acids and		med	ico-leg	gal as	pects.					
		is, Arsenic, Mercur											
		ous pesticides, isola				wcase	_	-					
		ction and estimation				tifying		_					
IV		tile Poisons: methy		10		nating					1 2	1,2	
1,4		roform. symptoms,	-	10		tile po		_		ng	'	- ,	
		ngs, isolation, detec			toxi	cologic	cal an	alysis.					
	estin	nation, medico-lega	l findings.										

V	Animal poisons, plant poisons, analysis of blood for alcohol, breath test instruments, Asphyxiants Cyanide, Carbon monoxide	10	Demonstrate expertise in analyzing various poisons, including animal and plant toxins, breath tests for alcohol, and detecting asphyxiants like cyanide and carbon monoxide, showcasing proficiency in toxicological	1,2
Practical	<ol> <li>Isolation techniques of different toxic substances.</li> <li>TLC of insecticides, Barbiturates and other drugs.</li> <li>Analysis of volatile and non-volatile poisons.</li> <li>Analysis of vegetable poisons.</li> <li>Spot test of nitrates, nitrites, carbonates, sulphates, sulphites, chlorates.</li> <li>Spot test of mercury, iron, copper, Aluminum and cadmium and zinc and other metallic poisons.</li> <li>Determination of alcohol in blood and urine sample</li> </ol>	30		1,2, 3,4

T1: The Toxicology is all about the studies drugs and poisons, their effect and analysis.

# **REFERENCE BOOKS:**

- R1: Gautam Biswas, *Review of Forensic Medicine and Toxicology*, 4th Edition, Jaypee Brothers Medical Publishers
- R2: K S Narayan Reddy, *The Essentials of Forensic Medicine and Toxicology*, 34th Edition, Jaypee Brothers Medical Publishers
- R3: F.G. Hofmann, A *Handbook on Drug and Alcohol Abuse*, 2nd Edition, Oxford University Press, New York.
- R4: S.B. Karch, *The Pathology of Drug Abuse*, CRC Press, Boca Raton.

### **OTHER LEARNING RESOURCES:**

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
	Understand the foundational knowledge and practical skills	
1	to identify and analyze toxic substances in forensic contexts	1, 3
	along with their practical aspects.	
	Explain the effects of psychotropic drugs and their	
2	implications in forensic investigations along with their	1
	practical aspects.	
3	Interpret metallic poison analysis and their medico-legal	1, 3, 8
3	aspects	1, 3, 6
	Analyze non-volatile and volatile poisons, understanding	
4	their effects and contributing to forensic investigations along	1, 3, 8
	with their practical aspects	
5	Analyze miscellaneous poisons contributing to forensic	1, 3, 8
	examination in complex and rare cases.	1, 3, 8

			SEM	IESTER – V	V								
Course Ti	itle		Adva	nced Instru	ıment	al Ana	lysis						
Course co	de	24BSFS313R	Total credits		L	T	P	S	R	O/F	С		
			Total hours:	30T+30P	2	0	2	0	0	0	3		
Pre-requi	site	Nil	Co-req	uisite			1	Nil					
Programm	me		Bachelo	r of Science	in Fo	rensic	Science	ee					
Semester			Fall/V Seme	ster of third	l year	of the	progr	amme					
Course		1. Introduce stude	ents to gas chr	omatograph	y (GC	) and l	iquid c	hroma	tograpl	ny (HP	LC),		
Objective	S	emphasizing th											
		2. Explore UV-	visible spect	rophotomet	ry, ir	nfrared	spec	tropho	tometr	y, Ra	aman		
		spectroscopy, A	2. Explore UV-visible spectrophotometry, infrared spectrophotometry, Raman spectroscopy, AAS, AES, and mass spectrometry.										
		3. Introduce neutr	ron activation	analysis, co	vering	basic	theory,	instru	mentati	ion, an	d the		
		detection and r	neasurement o	f gamma-ra	ys for	forens	ic appli	cation	s.				
		4. Cover transmi	ssion electron	n microsco	py (Tl	EM),	scanni	ng ele	ctron	micros	copy		
		(SEM), X-ray	techniques, X	-ray diffract	tion (X	(RD),	X-ray	fluores	scence	(XRF),	, and		
		their forensic a	pplications.										
		5. Introduce princ	-					_					
		centrifugation,		entrifugation	, and a	analysi	s of su	b-cellu	ılar frac	ctions u	ısing		
		ultra-centrifuge											
CO1		Describe chromatographic methods, including GC-MS and LC-MS, for forensic											
		analysis along with their practical aspects.											
CO2		Utilize various spectroscopic techniques for qualitative and quantitative forensic											
		analysis along with their practical aspects.  Apply knowledge of neutron activation analysis for qualitative and quantitative forensic											
CO3			of neutron ac	tivation ana	lysis fo	or qual	itative	and qu	iantitati	ive fore	ensic		
~~.		investigations.											
CO4		Apply knowledge of microscopy and X-ray techniques effectively in forensic											
COF		examinations for material and evidence analysis along with their practical aspects.											
CO5		Develop skills in applying centrifugation techniques for the separation and analysis of biological and forensic samples.											
Unit-			ensic samples.	Contact		Lag	unina (	Outoo	mo		KL		
No.		Content		Hour		Lea	rning (	Julcoi	ine	,	KL		
- 101	Gas	chromatography, T	Theoretical		Dem	onstra	te expe	rtise in	gas an	ıd			
		ciples, instrumenta						applyin					
	1 *	nnique, columns, sta			_		princip						
	1	ses, detectors, Pyro	-		techn	niques	for for	ensic a	nalysis				
I	GC	-MS, Forensic appl	ications.	7		_					1,2		
	Liq	uid chromatography	y, HPLC,										
	Rev	riew of theory, Insti	rumentation,										
	Tec	hnique, column, de	tectors, LC-										
	MS	, Forensic application	ons										
	UV	Visible spectropho	otometry,		Appl	y knov	vledge	of var	ious				
	Infr	ared spectrophoton	netry, Raman		spect	roscop	oic tech	niques	for				
	Spe	ctroscopy, AAS, A	ES				-		ing UV				
II				5		_	_		ry, infr	ared	1,2		
					_	_	tometry						
					_	_	-	S, AES	S, and n	nass			
					_	romet	•						
III		roduction, Review,	•	8		•			analys	sis	1,2		
and		principles, Instrum	entation-		princ	iples f	or qual	itative	and		- ,—		

	Various neutron sources, Detection		quantitative analysis in forensic	
	and measurement of Gamma-rays		applications.	
	for qualitative and quantitative			
	analysis, Forensic Applications			
	TEM SEM, X-Ray techniques, X-		Analyze and interpret forensic	
IV	ray Diffraction (XRD), X-ray	5	samples using advanced	1,2
1 4	Fluorescence (XRF and Forensic	3	microscopy techniques, X-ray	1,2
	Applications		diffraction, and X-ray fluorescence.	
	Basic principles of sedimentation,		Demonstrate proficiency in	
	Various types of centrifuges,		centrifugation principles,	
	Density gradient centrifugation,		techniques, and applications for	
V	Preparative centrifugation,	5	sub-cellular fractionation in	1,2
	Analysis of sub-cellular fractions,		forensic science.	
	Ultra-centrifuge- Refrigerated			
	Centrifuges.			
	1) To analyse samples using UV-			
	Vis spectrophotometer			
	2) To analyse sample using FTIR			
	3) To analyse sample GC/GC-MS			
	4) To analyse sample using			1 2 2
Practical	HPLC/LCMS	30		1,2,3,
	5) To analyse sample using GC-HS			4
	6) To analyse sample using			
	compound microscope			
	7) To analyse sample using			
	comparison microscope			

**T1**. D.A. Skoog, D.M. West and F.J. Holler, *Fundamentals of Analytical Chemistry*, 6th Edition, Saunders College Publishing, Fort Worth.

# **REFERENCE BOOKS:**

- R1. W. Kemp, *Organic Spectroscopy*, 3rd Edition, Macmillan, Hampshire.
- **R2**. J.W. Robinson, *Undergraduate Instrumental Analysis*, 5th Edition, Marcel Dekker, Inc., New York.
- **R3**: D.R. Redsicker, *The Practical Methodology of Forensic Photography*, 2nd Edition, CRC Press, Boca Raton.

### **OTHER LEARNING RESOURCES:**

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
	Describe chromatographic methods, including GC-MS and	
1	LC-MS, for forensic analysis along with their practical	1, 3, 8
	aspects.	
	Utilize various spectroscopic techniques for qualitative and	
2	quantitative forensic analysis along with their practical	1, 3, 8
	aspects.	
3	Apply knowledge of neutron activation analysis for	1, 3, 8
3	qualitative and quantitative forensic investigations	1, 3, 6
	Apply knowledge of microscopy and X-ray techniques	
4	effectively in forensic examinations for material and evidence	1, 3, 8
	analysis along with their practical aspects	
5	Develop skills in applying centrifugation techniques for the	1 2 8
3	separation and analysis of biological and forensic samples.	1, 3, 8

			SEM	ESTER – '	V							
Course T	itle		Tech	no Profess	ional C	ourse	- III					
Course c	ode	24BSFS314R	Total cred	its: 1	L	T	P	S	R	O/F	C	
			Total hour	rs: 30P	0	0	2	0	0	0	1	
Pre-requ	isite	Nil	Co-requisi					N	il		•	
Program	me			of Science								
Semester	•	Wi	nter/IV Sem	ester of Fi	irst year	r of th	e pro	gramı	me			
Course			ts to the instrumentation, principles, working mechanisms, and uses									
Objectiv	es	of tools in DNA laboratories.										
		2. Educate students						used	in toxi	cology		
		laboratories, emphasizing principles and applications.										
		3. Familiarize with			ballistic	s and	photo	graph	y laboi	ratories	and	
		understand their	* *		0 0							
		4. Acquire skills in		mentation	tor tinge	erprin	t analy	sis an	d ques	tioned		
		document exami		1 '41	ı· 1	1.	,•			,.	,•	
		5. Integrate theoret		•	actical a	ipplica	ations	in for	ensic ii	ivestiga	uions	
CO	1	using laboratory	umentation	nrincinles	and ann	licati	one of	toole	need in	DNA		
CO.	L	Understand the instrumentation, principles, and applications of tools used in DNA laboratories.										
CO2	2	Gain comprehensive knowledge of the instruments and techniques employed in										
	-	toxicology laboratories.										
CO3	3	Analyze different ty		s and their	social ar	nd psy	cholo	gical i	impacts	S.		
CO4 Evaluate sensational crime cas												
COS	5	Understand the struc	ture and hie	rarchy of th	ne justice	e syste	em and	d India	an inve	stigativ	'e	
		agencies.										
Unit- No.		Con tent		Contact Hour	Learning Outcome						KL	
	Instru	uments used in DNA			Maste	r the i	use of	PCR,				
т	Labo	ratory: Instrumentation	on,		electro	ophor	esis, a	nd				
I	princ	iple, working anduses	6	spectrophotometers for DNA						1,2		
	•			analysis								
	Instri	uments used in Toxico	ology		Learn	ins						
		ratory: Instrumentation			1		_					
II		iple, working and uses		6	6 using GC-MS, HPLC, and immunoassays.					1,2		
	princ	ipic, working and use.	o.		IIIIIII	110035	ays.				-,-	
	Incte	uments used in Ballis	tice and		Unda	etond	hallia	tic too	ols and			
III		ography Laboratory		6	iorens	ac pno	ologra	pny m	ethods	•	1,2	
		umentation, principle,	working								,	
	andu				<u> </u>							
		uments used in Finger	_		_			_	print a	nd		
IV	_	tioned document Lab	•	6	docun	nent a	nalysi	S.			1,2	
1 4	Instr	umentation, principle,	working	U							1,4	
	and u	ises										
	Instru	uments used in Serolo	gy	Gain skills in ELISA, cer					centrif	iges,		
**		ratory:Instrumentatio		_	and blo							
V		iple, working and use		6		3	1	_	1		1,2	
1												

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand the instrumentation, principles, and applications of	1, 8
	tools used in DNA laboratories.	ŕ
2	Gain comprehensive knowledge of the instruments and	1, 3, 8
_	techniquesemployed in toxicology laboratories.	1, 3, 6
3	Analyze different types of crimes and their social and	1
3	psychologicalimpacts.	1
4	Evaluate sensational crime case studies to gain practical insights	1
4	into criminology.	1
5	Understand the structure and hierarchy of the justice system	1.6
3	andIndian investigative agencies.	1, 6

			SEMESTER –										
Course			nentary Statistical anal	ysis & Ro									
Course	code	24BSFS316R	Total credits: 2		L	T	P	S	R	O/F		C	
	• • •	270	Total hours: 30T		2	0	0	0	0	0		2	
Pre-req		Nil	Co-requisite			~ •		N	il				
Program					e in Forensic Science								
Semeste	er	1 771	Fall/ 5 th semester of see							1			
Course			s to enhances the student					_			4	<b>من</b> م	
Objectives		research.	ncluding theory of science	ce and qua	ama	iiive a	ana c	_l uam	Itativ	e meu	ioa	SIII	
			ss to enhance the students	e, ekille fo	or de	ovelo.	nina	critic	oal the	inkino			
			ch literature review in dif				-			_			
		_	For preparation of a resea				_					[ini	
		research.	or preparation of a resea	ien propo	sai i	ioi a	ması	CI II.	icsis j	projec	L/ 1V]	11111	
			dents competency in plar	nning, con	duc	ting.	eval	uatin	g and	prese	ntii	ng a	
		research projec				,,,,			5	Press			
CO	)1			significan	ce o	of res	earc	h and	l idei	ntify r	ese	arch	
		Explain research methodology, evaluate significance of research and identify research problems.											
CO	2	Explain research design, sampling design and design experiment for research.											
CO	3	Collection and representation of data and interpret the data with descriptive statistics.											
CO	4	Explain to write re	eport, article, reviews etc										
CO	5	Explain intellectua	al property right and rela	ted rights									
Unit-		Cont	ent	Contact	8								
No.	D	136.1.11	A T . 1	Hour	T	7	1 1						
	1	rch Methodology-				Know	_						
	1	-	f research, motivation						ncep				
I		earch, types and sign	2					dolog			1,2		
	1	a of good research. ems- definition of re				_		eanii	ig search				
	1	sity of defining rese		a	illu O	ojeci	1005	or res	carcii				
			g and need of research			4 hle	to	unde	rstand	d and			
		n, features of a good	C			apply				nental			
	_	ch designs, Samplin	~			rinci				search			
			Size determination,		1 ^	lesign	•		ding	the			
II	_		npling design, different	4		_			_	sity of		1,2	
	1	•	Experimental Design,			esear	_			•			
	Princi	ples of Design of E	xperiment, One – way										
	ANO'	VA, Two- Way AN	OVA, CRD, RBD,										
	LSD,	22, 23 Factorial De	sign		_								
			data collection, tools			_			_	ge on			
			al, ordinal, interval and					-		ta and			
		- Attitude scale cons				•			ources				
	1		es, semantic differential			ind	too	ls	for	data			
III	1 '	Use of scale in stati	*	3	C	collec	tion					1,2	
		lules for interviews											
		standardization, development of survey											
	1	ments and item ana	lysis for the										
	•	onnaire	wagaanah maraant Errorr		<del> </del>	۸ <b>۱.</b> 1 -	4			<u> 1</u>			
IV			research report, Format	3		Able	to	_	anize			1,2	
	or res	earch report, Differe	em steps of writing	write a comprehensive									

	report, lay out of the research report, How to		research report	
	organize thesis/Dissertation, mechanics of		researen repert	
	writing research report, standard methods of			
	quoting- presenting the result, written and oral			
	reports, Uses of abstract, format of research			
	report, presentation of statistics - tabular and			
	graphic references and uses of references,			
	Bibliography and presentation of bibliography			
	Intellectual property right (IPR), Introduction		Knowledge on importance	
	and the need for IPR, IPR in India and		of Intellectual Property	
	worldwide, Patents, Trademarks, Copyright &		Rights (IPR) both in India	
	Related Rights, Industrial Design, Traditional		and globally	
<b>X</b> 7	Knowledge and Geographical Indications,	2		1.0
V	Patentable and non-patentable, patenting life,	3		1,2
	Filing of a patent application, The different			
	layers of the international patent system, Case			
	studies on Basmati rice, Turmeric, and Neem			
	patents			
	Laboratory using R Software:		Knowledge on various	
	1. Analysis of One way ANOVA;		statistical experiments and	
	2. Analysis of Two way ANOVA;		simulations using R	
	3. Analysis of CRD			
	4. Analysis of RBD			
Practical	5. Analysis of 22 and 23 Factorial Experiment	60		1,2,
Fractical	6. Simulation-I using R (Bernoulli, Binomial,			3,4
	Poisson and Geometric distribution.).			
	7. Simulation-II using R (Exponential and			
	Normal distribution).			
	8. Simple random Sampling			
	9. Stratified Random Sampling			

#### REFERENCES

- 1. Boyle JS. Styles of ethnography. In: JM Morse, editor. Critical issues in qualitative research methods.. Thousand Oaks, CA: Sage, 1994:159–85.
- 2. Coughlan M., Cronin P. and Ryan F. (2007). Step-by-step guide to critiquing research. Part 1: quantitative research. British journal of Nursing 16 (11).
- 3. Creswell, JW. (1998). Qualitative Inquiry and Research Design Choosing Among Five Traditions. Thousand Oaks, CA: Sage Publications.
- 4. Crotty, M. (1998). The Foundations of social research: Meaning and perspective in the research process. London: Sage.
- 5. Denzin, NK. (1978). Sociological Methods. New York: McGraw-Hill.
- 6. Hanson WE, JW Creswell, VL Plano Clark, KS Petska and JD Creswell. Mixed Methods Research Designs in Counseling Psychology. Journal of Counseling Psychology, 2005, Vol. 52, No. 2, 224–235. http://www.preciousheart.net/chaplaincy/Auditor_Manual/13casesd.pdf
- 7. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn & Bacon.
- 8. Kothari C., R. (2004). Research Methodology: Methods and Techniques. New Delhi. New Age International (P) Limited, Publishers.
- 9. Krueger, A. R. (1994). Focus Groups: A Practical guide for Applied Research, Thousand Oaks, CA: Sage Publications
- 10.L., L. Espinosa and M. Yamashita (2015). EvaluationToolkit. Evaluation Guide. Analyze Data.

- Retrieved from: http://toolkit.pellinstitute.org/evaluation-guide/analyze/analyze-qualitative-data/
- 11. Neuman, W. L. (2000). Social research methods. Qualitative and Quantitative approaches (4th Ed.). Boston: Allyn and Bacon.
- 12.Patton, MQ. (1999). "Enhancing the quality and credibility of qualitative analysis." HSR: Health Services Research. 34 (5) Part II. pp. 1189-1208.
- 13.Patton, MQ. (2001). Qualitative Evaluation and Research Methods (2nd Edition). Thousand oaks, CA: Sage Publications.
- 14.Strauss, A. & Corbin, J. (1994). "Grounded Theory Methodology." In NK Denzin & YS Lincoln (Eds.) Handbook of Qualitative Research (pp. 217-285). Thousand Oaks, Sage Publications.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain research methodology, evaluate significance of research and identify research problems.	3, 4, 8				
2	Explain research design, sampling design and design experiment for research.	3, 4, 8				
3	Collection and representation of data and interpret the data with descriptive statistics.	3, 4, 8				
4	Explain to write report, article, reviews etc.	3, 4, 8				
5	Explain intellectual property right and related rights	3, 4, 8				

		SEMESTEI	R - V									
Course Title		Ch	nemist	ry- 5								
Course code	24FSCH311R	Total credits: 3		L	T	P	S	R	O/F	С		
		Total hours: 30T + 3	30P	2	0	2	0	0	0	3		
Pre-requisite	Nil	Co-requisite				•	Nil		•	•		
Programme		Bachelor of Scientific										
Semester		Fall/ 5 th semester of										
Course	1	eparation, properties, ar	nd reac	ctions	of nit	rogen-	contai	ning o	rganic			
Objectives	compounds.											
	· ·	spectroscopy principle		_		_	_					
	· ·	ynamic relationships, c		_					_			
		chemistry, photochemic					_					
CO1		egical role of essential to gain knowledge abou								miaal		
COI		gani knowledge abou gen containing organic	•				•					
	named reactions.	gen containing organic	comp	ound	s such	as III	iro and	i amm	ics and	шеп		
CO2		pply the concept of N	MR in	sion	als int	erpret	ation o	of PM	R speci	tra of		
	simple organic mo		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	51511		orpro		,1 1111	et spee.			
CO3			gnetic	light	with n	natter	and th	e diffe	rent la	ws of		
		erstand the interaction of electromagnetic light with matter and the different laws of ochemistry associated with it.										
CO4	Understand the co	ordination of different	metal	ions	presen	t in the	e biolo	gical s	systems	h.		
CO5	Understand the m	olecular techniques ass	ociate	d witl	n rama	n and	electro	nic sp	ectrosc	ору		
Unit-No.	Cor	ntent	Cont	tact	t Learning Outcome KL							
			Ho	ur								
	Organic Compounds	~					activit					
	a) Nitro Compounds				nitrog	gen co	mpoun	ds				
	Preparation of nitroa											
	nitroarenes. Chemic											
	nitroalkanes. Miecna substitution in nitroa	nism of nucleophilic										
	reactions in acidic, n											
	media, Picric acid.	icutiai and aixanne										
	b) Amines											
		and nomenclature of										
	amines, physical pro		6							1,2		
		mines Separation of										
	a mixture secondary	and tertiary amines.										
	Structural features e	ffecting the basicity										
		lts as phase-transfer										
		tion of alkyl and aryl										
	amines (reduction of	•										
	and nitriles), reducti											
	aldehydic and keton	-										
	-	reaction, Hoffmann										
	bromamide reaction.	•										

	T =		T	1
	Spectroscopy-II: Nuclear magnetic		Interpret basic NMR	
	resonance (NMR) spectroscopy.		spectra of organics.	
	Proton magnetic resonance (1H NMR)			
	spectroscopy, nuclear shielding and			
	deshielding, chemical shift and molecular			
II	structure, spin-spin splitting and coupling	6		1,2
	constants, areas of signals interpretation of			
	PMR spectra of simple organic molecules			
	such as ethyl bromide, ethanol,			
	acetaldehyde, 1,1,2 tribromoethane, ethyl			
	acetate, toluene and acetophenone.			
	Thermodynamics-III (15 hrs)		Apply thermodynamic	
	Maxwell's relationships, Gibbs-Helmholtz		equations and concepts.	
	equation, Partial molar properties, Concept		equations and concepts.	
	of chemical potential, Gibbs-Duhem			
Ш	equation, Variation of chemical potential	6		1,2
	with T and P, Clapeyron-Clausius			
	equation, Third law of thermodynamics,			
	Nernst heat theorem, statement and			
	concept of residual entropy, evaluation of			
	absolute entropy from heat capacity			
	Photochemistry- Interaction of radiation		Explain photochemical	
	with matter, difference between thermal		processes and quantum	
	and photochemical process. Laws of		yield.	
	photochemistry: Grothus-Drapperlaw,			
IV	Stark-Einstein law, Jablonski diagram			1.2
1 V	depiciting various processes occurring in	6		1,2
	the excited state, qualitative description of			
	fluorescence, non- radiative processes			
	(internal conversion, intersystem crossing),			
	quantum yield.			
	Bioinorganic Chemistry - Essential and		Understand the biological	
	trace elements in biological processes,		role of metal ions.	
	metalloporphyrins with special reference			
V	to haemoglobin and myoglobin. Biological	6		1,2
	role of alkali and alkaline earth metal ions	_		'-
	with special reference to Ca+2, Nitrogen			
	fixation.			
	Synthesize nitroalkanes or nitroarenes			
	and study their chemical properties.			
	2. Separate a mixture of secondary and			
	tertiary amines using chemical			
	methods.			
D 41 7	<b>3.</b> Synthesize primary amines through the	20		1 2 2 4
Practical	Gabriel-phthalimide reaction.	30		1,2,3,4
	4. Analyze the PMR spectra of simple			
	organic molecules like ethanol, toluene, and ethyl acetate			
	5. Measure fluorescence and determine			
	the quantum yield of a photochemical			
	reaction.			
TEVT DO		i	1	1

T1: Fundamentals of Organic Chemistry, Solomons, John Wiley.

T2: Principles of Physical chemistry, Puri ,Sharma, Pathania.

T3: Spectroscopy, Pavia, Lampmann, Kriz,

# **REFERENCE BOOKS:**

R1: Organic Chemsitry, Morrison and Boyd, Prentice-Hall.

R2: Organic Chemistry. F.A. Carey, McGraw Hill, Inc.

R3: S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International.

# OTHER LEARNING RESOURCES:

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand and gain knowledge about synthesis, physical properties and chemical reactions of nitrogen containing organic compounds such as nitro and amines and their named reactions.	1
2	Understand and apply the concept of NMR in signals interpretation of PMR spectra of simple organic molecules.	1
3	Understand the interaction of electromagnetic light with matter and the different laws of photochemistry associated with it	1
4	Understand the coordination of different metal ions present in the biological systems	1
5	Understand the molecular techniques associated with raman and electronic spectroscopy.	1

			SEMESTE	R – V						
Course T	itle		]	Physics-	- 5					
Course c	ode	24FSPH312R	Total credits: 3	L	T	Р	S	R	O/F	C
			Total hours: 30	2	0	2	0	0	0	3
Pre-requ	isite	Nil	Co-requisite Nil							
Program	me		Bachelor of Sci	ience in	For	ensic Sc	eience			
Semester	•		Fall/ 5 th semester of	f second	yea	ar of the	prog	ram		
Course		1. Understand nu	clear constituents, b	oinding	ene	rgy, and	l mass	s-ener	gy relation	ns.
Objective	es	2. Study types of	radioactivity and th	ne princ	iple	s of alp	ha, be	ta, and	d gamma	decay.
		3. Explore nuclea	r fission, fusion, an	d energ	ус	onsidera	ations	in nuc	elear react	ions.
		_	r fission, fusion, and energy considerations in nuclear reactions. iples and operation of nuclear detectors.							
		_	classification of el					vpes o	of interact	ions.
CO1			nstituents and gener					_		
			d the condition for N				,			1010111
CO2	,		rent types of radiati				beta	and ga	amma and	their
		properties.	71			1 /		8		
CO3		* *	ent types of nuclear re	eaction a	ınd o	calculate	the Q	value	of reaction	1.
CO4		•	dea of radiation detec					·		
CO5		Summarize the ba	sic of particle physics	s, types o	of pa	articles a	ınd coı	nserva	tion laws	
Unit-		Conte		Contac				g Outo		KL
No.		20		Hour				,		
	Cons	stituents of nucleus	and their intrinsic			Describe	e nucle	ear stru	icture and	
	prop	erties, isotopes and	7	binding energy.						
		overy of neutrons, p			C	· .				
I	neuti	rons, binding energy							1,2	
	ener	gy and its variation								
	main	features of binding	energy versus							
	mass	number curve.								
	Radi	oactivity, α, β, γ rac	liation and their			Explain	alpha,	beta,	and	
	prop	erties, Alpha decay:	basics of α-decay	5		gamma	decay	proces	ses.	
	proc	esses, theory of $\alpha$ - e	mission, Geiger-							
II	Nutt	all law, β-decay: en	ergy kinematics for							1,2
	'	ecay, positron emiss	·							
		ure, neutrino hypoth								
		emission & kinema								
		ear fission and fusion	· · · · · · · · · · · · · · · · · · ·			Underst				
		lition for nuclear fus	·	8		fusion, a	and ma	ıss def	ect.	
III		nonuclear reaction,								1,2
		ideration in nuclear	·							
		ct and Q-value of a				0 .	1.		. 1.	
		c idea of nuclear de	·	_		_		_	t readings	
		ctors, ionization cha		5		from nu	ciear c	ietecto	rs.	
IV		nter. Basic principle ectors and constructi								1,2
		o-multiplier tube (P.	-							
	^	iconductor Detector	*							
		sification of elemen			+	Classify	eleme	ntaru	particles	+
		ons, leptons, meson	• •			and inte		• .	•	
V	-	particles, concept of	_	5		and mic	i activi	rypes	•	1,2
	_	es of interactions, w	•							
	Type	o or interactions, w	cars, strong and							1

	electromagnetic interactions		
Practical	<ol> <li>To study the radioactive decay of α, β, and γ sources.</li> <li>To measure the half-life of a radioactive isotope.</li> <li>To calculate the binding energy per nucleon of a nucleus.</li> <li>To observe the process of nuclear fission and measure the energy released.</li> <li>To study electron capture and positron emission.</li> </ol>	30	1,2, 3,4

T1: Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill).

# **REFERENCE BOOKS:**

R1: Introduction to Elementary Particles, D. Griffith, John Wiley & Sons

R2: Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.

R3: Radiation detection and measurement, G.F. Knoll (John Wiley & Sons).

# OTHER LEARNING RESOURCES: Pathsala- Online Learning Platforms

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Understand the constituents and general properties of nuclei, and learn about different nuclear models and the condition for Nuclear Stability.	1					
2	Explain the different types of radiation such as alpha, beta and gamma and their properties.	1					
3	Explain the different types of nuclear reaction and calculate the Q value of reaction	1					
4	Discuss the basic idea of radiation detector	1					
5	Summarize the basic of particle physics, types of particles and conservation laws.	1					

			SEMESTEI	R – V	V						
Course T	itle			Biol	ogy- 5						
Course co	ode	24FSBO313R	<b>Total credits: 3</b>		L	T	P	S	R	O/F	C
			Total hours: $30T + 3$	0P	2	0	2	0	0	0	3
Pre-requi	site	Nil	Co-requisite					Ni	il		
Programi	me	Bachelor of Science in Forensic Science									
Semester	į i e										
Course			eneral plant classificati								
Objective	es	purposes. 3. Provide know 4. Explore the	3. Provide knowledge on poisonous plants and their forensic importance.								
CO1	-	Understand ger	eral plant classification	and	foren	sic su	b-spec	cializa	tions		
CO2		Identify and ma	atch various types of wo	ods,	timbo	ers, se	eds, a	nd lea	ves fo	rensical	ly.
CO3			onous plants and their f								
CO4			e importance of wildlif					relev	ant ac	ts.	
CO5			yielding drugs of abuse								
Unit-		Cor	ntent			ontact Learning Outcome			ome	KL	
No.				]	Hour						
I	scher botar plant	mes. Sub special ny- plant morpho systematic, paly achitecture- roo	nd their classification lization of forensic logy, plant anatomy, mology, plant ecology, ts, stems, flowers,		6		fores	. –	and p	oolicies	1,2
п	and l Ident of we Type exam	ification and ma ood, timber varies of fibers – fore ination- fluoresc	pers, seeds forensic importance. Itching of various types stries, seeds and leaves. It ensic aspects of fiber tent, optical properties, fringence, dye analysis		6	m	Importance, scope and morphology of woody forest and Ecotourism.			1,2	
III	preca occio Calo purpi bella super Mani Nico	uria, Cinchona, C donna, Erythrox rb, Jatropha curc ihot utilissima, N	n, Anacardium ne mexicana, sativa, Claviceps Croton tiglium, Atropa ylum coco, Gloriosa as, Lathyrus sativus,		8	ph	Importance of tree physiology in relation to forestry			1,2	

IV	Importance of wild life. Protected and endangered species of animals and plants.  Sanctuaries and their importance. Relevant provision of wild life and environmental act.  Types of wildlife crimes, different methods of killing and poaching of wildlife animals.	5	Importance of forest ecosystem, biotic and abiotic Components and forest management and ecotourism.	1,2
V	Plants yielding drugs of abuse – opium, cannabis, coco, tobacco, dhatura, Psilocybin mushrooms.	5	Principle of forest pathology causes of forest diseases and plant quarantine.	1,2
Practical	<ol> <li>Morphological study of different types of plants like herbs, shrubs and trees.</li> <li>Anatomical study of tissues of stem, root and leaf.</li> <li>Identification and comparison of natural and man-made fibre.</li> <li>Identification of Poisonous plants</li> </ol>	30		1,2, 3,4

T1: Agarwal, W.P. Forests in India. Oxford and I.B.H

T2: Arvind Kumar. Biodiversity and environment. A.P.M. Publishing Corporation, New Delhi

T3:Kumar and Asija. Biodiversity – Principles and conservation. Updesh Purohit, Agrobios, Jodhpur

# **REFERENCE BOOKS:**

R1: Raghavendra AS. Physiology of Trees.

**R2:** John Wiley & Sons. Taiz, L. and Zeiger, E. Plant Physiology 4 th Ed. Sinauer Associates Inc. Publishers, Sunderland.

### **OTHER LEARNING RESOURCES:**

Pathsala- Online Learning Platforms

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped ProgramOutcome				
1	Understand general plant classification and forensic subspecializations.	1				
2	Identify and match various types of woods, timbers, seeds, and leaves forensically.	1				
3	Recognize poisonous plants and their forensic significance	1				
4	Comprehend the importance of wildlife, wildlife crimes, and relevant acts	1				
5	Identify plants yielding drugs of abuse for forensic analysis.	1				

	SEMESTER – VI									
Course Title			ltimedia F				l ~	-	6 =	
Course code	e 24BSFS321R	Total credits: 4		L	T	P	S	R	O/F	C
Duo mografica	o NO	Total hours: 45T		3	0	2	0 Nil	0	0	4
Programme		Co-requisite Bachelor of S		For	ongia (	Saiona				
Programme Semester		Winter/ VI Semeste						16		
Course		ledge of imaging a							stand-	alone
Objectives		ipheral devices, stora								
o bjectives		emote acquisition								
		ormats of forensic in								
		stry and logging in								
		of system logs,	kernel lo	gs,	event	logs,	and	applic	cation	web
	servers/proxy	•	1 .			1. 1		4 1	1	1.
		in forensic audio as, acoustic analysis, a							igital i	media
		processing technique							ompre	ession
	1 *	ication, and super re		_			_		•	
CO1		s of acquiring digita			_					
CO2	Apply remote ac	equisition methods	and emplo	oy v	various	s softv	vare/h	ardwar	e too	ls for
	forensic image ac	quisition and delete	d data reco	very	y along	g with	their p	oractica	ıl aspe	ects.
CO3	_	nensive registry and		•		_			tion o	f logs
		machines and server								4.
CO4		audio analysis teo								
	practical aspects.	nd automatic speake	r recognition	on 11	11 1800	raiory	semng	gs alon	g with	ıneır
CO5		erpret various audi	o and vid	eo e	eviden	ces fr	om va	arious	multii	nedia
	_	th their practical asp								
Unit-No.	Cont	ent	Contact Hour	9						KL
	Imaging/acquisition	& data recovery	Hour	In	าลอเ่ทอ	/Acan	isition	& Dat	а	
	Acquisition of stand	•	Imaging/Acquisition & Data Recovery: Acquire and							
	peripheral device, ot			recover digital evidence from					m	
	CCTV, systems (bot	_	diverse sources, including							
I	logical), Acquisition		8	1				s, mobi	ıle	1,2
	collection of live sys	-		1	evices, estems	and n	etwork	tea		
	of mobiles, PDA's, T	•		Sy	Stellis					
	systems etc.									
	Acquisition over the	network i.e.		Aı	pply re	emote	acquis	ition		
	remote acquisition, U			m	ethods	and u	tilize	various		
	various acquisition s			1				ols for		
II	device, details of var	rious audio	7	1		_	_	sition a	and	1,2
	enhancement, digital	l media		ae	eleted o	uata re	covery	/.		•
	authentication, acous									
automatic speaker recognition										
	Registry and Loggin	g: Understanding		Co	onduct	in-de	pth an	alysis c	of	
	and in-depth analysi	s of registry in					-	n vario		
111	various operating sys	stems, Log	10					nhancii		1.2
Ш	analysis, machine an	d server, system	10					ities in		1,2
	logs, kernel logs, eve	ent logs, ftp/sftp,		al	gital fo	)1 CHS1(	28			
	application Web Ser									
<u> </u>			1	1						

IV	File Forensics: Data Acquisition and Authentication Process, Windows Forensic Analysis of File Systems- FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, Embedded System Analysis, Network Forensic Analysis Overview, Cloud Computing-an introduction.	10	Apply techniques in audio enhancement, digital media authentication, and automatic speaker recognition for effective forensic audio analysis in the laboratory.	1,2
V	Video processing: re-sampling algorithms (rotation scaling) and their identification, super resolution.	10	Apply advanced video processing techniques, including re-sampling algorithms and compression history identification, enhancing skills in forensic video analysis and evidence interpretation	1,2
Practical	<ol> <li>Recording of speech samples using tape recorder &amp; digital recorders and measures for keeping it in the safe custody.</li> <li>Comparison of linguistic and phonetic features of audio recording voice samples of two speakers.</li> <li>Perform Steganography and Steganalysis.</li> <li>Encrypting and decrypting the partition using Bit locker.</li> <li>Collection and preservation of volatile data from standalone computer.</li> <li>Imaging and recovery of deleted files and folders from storage media.</li> </ol>	30		1,2,3,

**T1**: Husrev Taha Sencar and Nasir Memon, Digital Image Forensics: There is More to a Picture than Meets the Eye, Springer Science and Business Media, New York.

### **REFERENCE BOOKS:**

R1: Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Prentice-Hall, Inc.Upper Saddle River, NJ, USA.

R2: Alan Bovik, Handbook of Image and Video Processing, Academic Press, USA.

### OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Describe the types of acquiring digital evidence from a variety of sources.	1, 6
2	Apply remote acquisition methods and employ various software/hardware tools for forensic image acquisition and deleted data recovery along with their practical aspects.	1, 2, 3
3	Conduct comprehensive registry and logging analysis, including the examination of logs from standalone machines and servers, enhancing investigative capabilities	1,3
4	Utilize forensic audio analysis techniques for audio enhancement, digital media authentication, and automatic speaker recognition in laboratory settings along with their practical aspects	1, 6
5	Analyze and interpret various audio and video evidences from various multimedia sources along with their practical aspects.	1, 3

SEMESTER – VI														
Course Title			Forensic Medicine											
Course code	e 24BSFS322R	Total credits: 4 Total hours: 45T	+30D	$\frac{L}{3}$	T 0	P 2	S 0	R	O/F 0	C 4				
Pro requisit	te Nil	Co-requisit		3	U	L	U Nil	·	U	4				
Pre-requisit Programme				For	orensic Science									
Semester		Winter/ VI Semeste						me						
Course		idents to the funda							ic med	dicine,				
Objectives		ferent types of inc	quests and	d the	roles	of o	ral ev	idenc	e and	dying				
	declarations.		0.1 .1											
		nedico-legal aspects				the dia	ignosi	s, stag	es, and	l signs				
		vell as different type wledge on the au				ludino	inte	rnal a	and ex	xternal				
		, sample collection												
	suicidal cases		,		υ									
		ents on the types ar												
	_	rtem injuries, and	specific	injur	y typ	es lik	e bite	mar	ks and	l burn				
	injuries. 5 Familiarize s	etudents with form	sic entom	olom	, incl	ludina	the	ectimo	tion o	f time				
		5. Familiarize students with forensic entomology, including the estimation of time since death and the factors affecting decomposition.												
CO1						sic m	edicin	e and	the di	fferent				
	types of inquests	Understand the fundamental aspects and scope of forensic medicine and the different types of inquests and evidence in legal investigations.												
CO2		Diagnose the medico-legal aspects of death, recognizing the stages and signs of death												
602		ses of fatal incidents		1										
CO3					rnal and external examinations, sample									
CO4		collection, and the investigation of specific cases like sexual offences and suicides  Identify and classify different types of injuries, distinguishing between antemortem and												
	1	postmortem injuries.												
CO5		entomology techniqu	ues to esti	mate	the ti	me sir	ice de	ath an	d unde	erstand				
	the decomposition	_	l ~ .											
Unit-No.	Cont	ent	Contact Hour	t	Le	arnin	g Out	come		KL				
	Forensic medicine, p	athology, police		De	escribe	e the s	cope (	of fore	nsic					
	_	nquest, magistrate inquest, oral evidence, dying declaration, kind of			medicine and the roles of different types of inquests and									
I														
	witnesses, Fundamer	8	evidence.						ĺ					
		cope of forensic medicine.												
		t its medico legal aspects,				Recognize the signs and stages								
	diagnosis of death, s	iagnosis of death, stages of death, igns of death, ashyxial death, death ue to Starvation, death due to			of death and understand									
тт	signs of death, ashyx				various causes of death from a									
II	due to Starvation, de				medico- legal perspective.					1,2				
	drowning, death due													
	Anaesthetics deaths.													
III	Autopsy: medico leg	-			rform	_			and					
	internal and external		preserve samples, and investigate specific medico-											
	Sample collecting, sa													
	techniques, preserva	10	legal cases 1,											
	Causes of death. Inve													
	sexual offences, exh													
	bodies), suicidal case													
	Injuries: Types an		Identify and classify injuries,											
IV	of injuries. Antemor	distinguishing between ante						1,2						
1 V	mortem injuries. Bite	e marks, burn	10	mo	ortem	and po	ost-mo	mortem and post-mortem injuries						
	injuries, head injury.					_								

V	Estimation of time since death, Stages of decomposition of corpse, geographical & seasonal effect on decomposition.	10	Estimate the time since death and understand the factors affecting decomposition	1,2
Practical	<ol> <li>To design a questionnaire for the first responder to the death scene.</li> <li>To design a checklist for the forensic scientists at the death scene.</li> <li>To analyze and preserve bite marks</li> <li>To design a canvass form giving description of an unidentified victim.</li> </ol>	30		1,2,3

T1: J P Modi, A Textbook of Medical Jurisprudence and Toxicology, Lexis Nexis

### **REFERENCE BOOKS:**

- R1: Gautam Biswas, *Review of Forensic Medicine and Toxicology*, 4th Edition, Jaypee Brothers Medical Publishers
- R2: K S Narayan Reddy, *The Essentials of Forensic Medicine and Toxicology*, 34th Edition, Jaypee Brothers Medical Publishers
- R3: F.G. Hofmann, A *Handbook on Drug and Alcohol Abuse*, 2nd Edition, Oxford University Press, New York.
- R4: S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton.

# OTHER LEARNING RESOURCES:

E-Pathsala- Online Learning Platforms

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Enable effective handling of death investigations through crime scene management and initial medical response.	1, 2, 6					
2	Recognize suspects, conduct interrogations, and manage crime scenes, including crowd and media control.	1, 3					
3	Discuss effective handling of buried body and suicide cases, emphasizing search methods and psychological assessment	1, 3, 6					
4	Develop skills in conducting autopsies, evaluating injuries, and examining causes of death in forensic medicine	1, 4, 8					
5	Identify, classify, and evaluate injuries, distinguishing between ante mortem and postmortem injuries and understanding aging and artificial aspects along with their practical aspects.	1, 3					

SEMESTER – VI												
Course Title Chemistry- 6												
Course code		24FSCH321R	Total credits: 3	L	T	P	S	R	O/F	C		
			Total hours: 30T + 30P	2	0	2	0	0	0	3		
Pre-requi	site	Nil	Co-requisite	Nil								
Programm	ne	Bachelor of Science in Forensic Science										
Semester		Fall/ 5 th semester of second year of the program										
Course		1. To understand and gain knowledge about carbohydrates, proteins and nucleic acids.										
Objective	S	2. To understand the preparation, characteristics and chemical reactions simple and										
		condensed five and six membered heterocyclic compounds.										
		3. To understand the knowledge about bonding in metal carbonyls, as well as gain the										
		idea about the different phases of matter										
COI		1	gain knowledge about carbol	•								
CO2			gain knowledge about protein									
CO3			simple and condensed 5/6 r			tero	cyclic	compo	ounds,	their		
CO4		preparation, characteristics and chemical reactions.  Discuss about preparation properties, application and the nature of bonding in metal										
004	•	carbonyl	eparation properties, applied	шоп	and the	mai	urc or	oonan	ng m i	nctai		
CO5			rent phases of matte and the	ir eq	uilibria	from	whicl	n the s	tability	and		
		-	sustainability can be predicted.									
Unit-		C	ontent	C	ontact	Le	arnin	g Outo	come	KL		
No.				] ]	Hour							
		rbohydrates: Classification and nomenclature,					assify a					
		nosaccharides, mechanism of osazone				interconvert						
		nation, interconversion of glucose and fructose,				car						
		n lengthening and chain shortening of aldoses.				dei	rivativ	es.				
		iguration of monos										
		diastereomers. Con										
I		ose. Formation of	S.	10					1,2			
		mination of ring s										
		c structure of D (+										
		rotation. tures of ribose and										
	1	ttroduction to disaction										
		actose) and polysa										
	1	out involving struct										
			es, Proteins and Nucleic	+		Un	dersta	nd				
		cid: Classification, structure and stereochemistry					ucture					
		nino acids. Acid ba				pertie		nino				
		and electrophores			_	ds, pe						
	_	amino acids.				oteins,	•					
	Struc	ture and nomencla			_	cleic a						
II	prote	ins. Classification		0					1.0			
	struct	ture determination		8		1,2						
	selec	tive hydrolysis of 1										
	_	in structure. Protei										
	renat	uration.										
		eic acids: Introduc										
		Ribonucleosides a										
		le helical structure										
III	Hete	rocyclic Compo	and: Introduction:		10	Sy	nthesiz	ze and	react	1,2		
	<u> </u>									- ,-		

	Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophlic substitution. Mechanism of nucleophlic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.  Introduction to condensed five and six membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophlic substitution reactions of indole,		heterocyclic compounds.	
IV	quinoline and isoquinoline  Organometallic Chemistry: Definition,  Nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls,of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.	10	Explain properties and applications of organometallic compounds.	1,2
V	Phase Equilibrium: Phase, Components, Degree of freedom, Derivation of phase rule, one-component systems, water system and S-system, two component systems, simple eutectic systems, Pb-Ag systems, formation of compounds with congruent melting points, and incongruent melting points.	7	Apply phase rule to phase equilibria systems.	1,2
Practical	<ol> <li>To classify and identify monosaccharides such as glucose and fructose.</li> <li>To study the mutarotation and optical activity of D(+)-glucose.</li> <li>To prepare peptides and study the denaturation and renaturation of proteins</li> <li>To study the electrophoretic behavior of amino acids and proteins.</li> <li>To synthesize and study reactions of heterocyclic compounds like pyrrole, furan, thiophene, and pyridine</li> </ol>	30		1,2, 3,4

#### **TEXT BOOKS:**

- T1: Fundamentals of Organic Chemistry, Solomons, John Wiley.
- T2: Principles of Physical chemistry, Puri ,Sharma, Pathania.
- T3: Spectroscopy, Pavia, Lampmann, Kriz,

#### **REFERENCE BOOKS:**

- R1: Organic Chemsitry, Morrison and Boyd, Prentice-Hall.
- R2: Organic Chemistry. F.A. Carey, McGraw Hill, Inc.
- R3: S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International.

#### **OTHER LEARNING RESOURCES:**

Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand and gain knowledge about carbohydrates.	1
2	Understand and gain knowledge about protein and nucleic acid.	1
3	Understand the simple and condensed 5/6 membered heterocyclic compounds, their preparation, characteristics and chemical reactions	1
4	Discuss about preparation properties, application and the nature of bonding in metal carbonyl	1
5	Identify the different phases of matte and their equilibria from which the stability and sustainability can be predicted.	1

			SEMESTER – VI							
Course Ti	itle		Physics-	- 6						
Course co	de	24FSPH322R	Total credits: 3	L	T	P	S	R	O/F	
			Total hours: 30T + 30P	2	0	2	0	0	0	3
Pre-requi		Nil	Co-requisite				Nil			
Programi	ne	_	Bachelor of Science in							
Semester			Fall/ 5 th semester of second					1.		
Course	~		properties and working med							ED.
Objective	S		tions of two-terminal device eteristics and behavior of bi							EDS.
		•	fication, working, and appli							
			fundamentals of analog ar			_		_	_	and
		logic gates	8	8		,			, ,	
CO1			c process in the formation a	and fabri	icati	on of P	N junc	tion d	evices	S.
CO2		Summarize the know								
CO3			e integrated circuits such as				plicati	ons.		
CO4		_	ea of amplifiers and their fr			_				
CO5	_		of analog and digital circui							
Unit-		Cor	ntent	Conta		Lear	ning C	utcor	ne	KL
No.		· 1 . D: 1 .	137.	Hou		F 1 '				
		iconductor Diodes: I	• •	7	Explain semiconductor diode					
I		semiconductors, energy level diagram, conductivity and mobility, concept of drift					or and			1,2
1		velocity, fabrication of PN junction current flow				flow	or and	curre		1,2
		hanism in forward ar			110					
	Two	o-terminal devices an	d their applications: Half-			Analy	ze recti	fiers.		
		re rectifiers, full-wave		5 Zener diodes, and						
***			d rectification efficiency,				in circi			1.0
II	c-fil	c-filter, Zener diode and voltage regulation,								1,2
		ciple, Principle and s								
		todiode and Solar Ce								
	_		ors: N-P-N and P-N-P				stand E			
III			istics of CC, CB and CE	8			teristic			1,2
		-	ains $\alpha$ and $\beta$ and their			curren	t gains			
		tions. plifiers, classification	of class A R & C			Decim	n and a	กลใบร	<u> </u>	
			C-coupled amplifier and	5		_	i and a ier circ	•		
IV		requency response, ir	• •			_	np app			1,2
1,		racteristics of an Op-			op 111	PPP			-,-	
		Amps.								
	Diff	ference between analo	og and digital circuits,			Apply	Boolea	an		
		•	s of Boolean algebra,	5		algebra	a and v	vork v	vith	
		_	s (realization using diodes			logic g	gates.			
V		transistor), NAND an	-							1,2
			1 XNOR gates, Active							
			concepts of ICs (basic							
ide		only)								

Practical	<ol> <li>To study the current-voltage characteristics of a P-N junction diode.</li> <li>To design and test half-wave and full-wave rectifiers.</li> <li>To study the application of a Zener diode as a voltage regulator.</li> <li>To study the working principles of LED and</li> </ol>	30	1,2, 3,4	
Practical	voltage regulator.	30		

#### **TEXT BOOKS:**

T1: Electronics fundamentals and applications –D. Chattopadhyay and P.C. Rakshit.

#### **REFERENCE BOOKS:**

R1: A Text Book Of Electronics –S.L. Kakani & K.C. Bhandari

R2: Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, PHI Learnin.

R3: Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed Tata McGra).

#### **OTHER LEARNING RESOURCES:**

Pathsala- Online Learning Platforms

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped ProgramOutcome			
1	Understand the basic process in the formation and fabrication of PN junction devices.	1			
2	Summarize the knowledge of rectifiers.	1			
3	Understand versatile integrated circuits such as Op-Amp and its applications.	1			
4	Explain the basic idea of amplifiers and their frequency response	1			
5	Understand the idea of analog and digital circuit and different types of gates.	1			

	SEMESTER – VI									
Course Ti	itle		Biolo	ogy- 6						
Course co	de 24FSBO323R	Total credits: 3		L	T	P	S	R	O/F	C
		Total hours: 30T + 3	30P	2	0	2	0	0	0	3
Pre-requi	site Nil	Co-requisite					Nil			
Programm	ne	Bachelor of Sc								
Semester		Fall/ 5 th semester o								
Course		knowledge on impor	tance	of wi	ldlife,	ethics	and n	nanage	ement to	actics
Objective	I			22						
	I	ne information regarding		fferent	t conse	ervatio	n prog	ramm	e adopt	ed in
		conservation of wildlife		. •	C					
CO1		nowledge on structure a						1 4	1 C	.1
CO1		ifferent conservation	strat	egy	and p	rogran	nmes	adopt	ed Ioi	the
CO2	Conservation of	ethics and managemen	+ +0.01	ing for	:1.41:	fo con	~ ~ w . ~ +			
CO2		acture and function of e			WIIGH	ne con	servati	OII		
CO ₄		Wildlife Protection Act			ita imn	lamant	otion			
										C
CO5		rent conservation prog	gram	adopt	ed in	India	ior th	e con	servatio	on of
Unit-	wildlife			toot	tact Learning Outcome					KL
No.	Content Contact Learning Outco			accom	e	KL				
110.	Wildlife Importance	and Conservation-	110	,uı	Stude	nts wil	1 unde	rstand	the	
	Definition and impor		importance of wildlife a							
I	Causes of depletion,	·		5	_	of their				1,2
1	_	rks, Wildlife sanctuaries and biosphere								
	reserves of India	-								
	Environmental Ethics	s and Management-			Stude	nts wi	l be al	ole to l	know	
	Conservation and ma	nagement of			ethics	and m	nanage	ment t	actics	
	Wildlife, In-situ cons	ervation and ex-situ				ildlife				
	conservation									
l II	Innovative Methods i	n Wildlife: Camera	,	7						1,2
11	Trap, Conservation I	Prones, Remote		<b>'</b>						1,2
	Sensing, Radio Teler	· ·								
	Mobile App, Capturi	-								
		, Darting, tagging and								
	banding, Scat analysi	· • • • • • • • • • • • • • • • • • • •			~ .					
	· ·	and Functions, Food				nts wil		_	_	
III	chain, Food web, Po	-	(	6		us appı			ıbıtat	1,2
111	Energy flow in an eco	•				gemen		ts		
	Pyramids, Concept o					icance		1	: 4	
	Wild life Protection A Wildlife Protection A	•				nts wil			idea	
IV	detailed structure, Re	, ,		5		PA, 19 mentat		1118		1,2
1 1 1	WPA 1972 and their			J	mpie	monid	IOII			1,4
	protection and Conse									
	protection and Collse	ı valluli								

V	Conservation Biology: Principles of conservation, Major approaches to management, Indian case studies on conservation/ management strategy (Project Tiger, Biosphere reserves)	7	Students will have understanding on different conservation programme adopted in India for the conservation of wildlife	1,2
Practical	<ol> <li>Documentation of different invertebrates/vertebrates present in the campus.</li> <li>Activity budgeting of any one species.</li> <li>Measurements of species diversity from provided data sheet using Shannon Winner Index (H').</li> <li>Measurements of similarity &amp; dissimilarity index of species from provided data sheet.</li> <li>Measurements of association index of species from provided data sheet</li> </ol>	30		1,2, 3,4

#### **TEXT BOOKS:**

- **T1:** An Introduction to Conservation Biology, Anna A. Sher and Richard B. Primack. Oxford University press.
- T2: Indian Wildlife Protection Act 1972. Anon. Natraj Publishers, Dehra Dun. 104p.
- T3: Fundamentals of Wildlife Management. Gopal, R. 1992. Justice Home. Allahabad. 668p
- T4: Conservation Biology for All. Navjot S. Sodhi and Paul R. Ehrlich Oxford University press
- **T5:** Conserving earth's biodiversity. Wilson, E. O., and D. Perlman. Island Press, Washington, D.C.

#### **REFERENCE BOOKS:**

- R1: Principles of Conservation Biology. Meffe. G.K. and C.R. Carroll. Sinauer Associates, USA.
- **R2:** Ecological Methods for Field and Laboratory Investigations. Michael, P.. Tata Mc Graw Hill Publishing Company Limited, New Delhi. 404 p.
- **R3:** Conservation Biology: Voices from the Tropics. Peter H. Raven, Navjot S. Sodhi, Luke Gibson, Willey Online library
- R4: Fundamentals of Ecology. Odum, E.P.. Natraj Publishers, Dehra Dun 574p.
- **R5:** Wildlife Ecology and Management. Robinson W.L. and Eric G. Bolen. Millen Publishing Co. New York

#### **OTHER LEARNING RESOURCES:**

Pathsala- Online Learning Platforms

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand different conservation strategy and programmes adopted for the conservation of wildlife.	1
2	Understand the ethics and management tactics for wildlife conservation.	1
3	Discuss the structure and function of ecosystem.	1
4	Discuss about Wildlife Protection Act, 1972 and its implementation	1
5	Illustrate different conservation program adopted in India for the conservation of wildlife.	1



# **Assam down town University**

# Curriculum and Syllabus

# Bachelor of Science in Biotechnology

# **OUTCOME BASED EDUCATION FRAMEWORK**

**CHOICE BASED CREDIT SYSTEM** 

Version: 2.2

**FACULTY OF SCIENCE** 

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the programme

and to be eligible for the degree. This volume also includes the prescribed literature, study

materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Member Secretary, Academic Council

Downey

#### Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

#### **Missions**

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multi disciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality inter disciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stake holders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

# **Programme Details**

#### **Programme Overview:**

B.Sc. in Biotechnology is a 3-year undergraduate programme which deals with basic and advanced study provides a comprehensive understanding of cell biology, molecular biology, and genetic engineering. Students learn the fundamentals of cell structure and function, gene manipulation techniques, and the principles of genetic engineering. The curriculum includes practical lab work, covering techniques like PCR, RFLP, and RAPD, and applications in vaccine production, gene therapy, and environmental biotechnology. Additionally, the program emphasizes ethical, social, and environmental responsibilities, preparing students for diverse biotechnological careers and further studies in this rapidly evolving field.

#### I. Specific Features of the Curriculum:

This program outcome aims to provide students with an in-depth understanding of biotechnology's diverse applications, preparing them for future opportunities in this dynamic field. Students will gain hands-on experience with molecular biology techniques and biotechnological instruments, essential for analysis, measurement, and experimentation. Additionally, the curriculum emphasizes the importance of environmental, social, ethical, and professional responsibilities, ensuring that graduates are not only technically proficient but also mindful of the broader impacts of their work. This holistic approach prepares students to be innovative and responsible professionals in biotechnology.

#### II. Eligibility Criteria:

Minimum 45% in 10+2 with English, Biology & Chemistry. 5% relaxation for SC/ST, EWS, and Specially abled candidates.

#### **III.** Program Educational Objectives (PEOs):

**PEO-1:** AdtU Biotechnology graduates will be well prepared for successful careers in industry and/or in government in one or more following areas: genetic engineering, microbial biotechnology, plant and animal biotechnology, pharmaceutical industries and food processing industries.

**PEO-2:** AdtU Biotechnology Graduates will be academically prepared to become biotechnologist and will contribute effectively to the growth of the profession.

**PEO-3:** The Graduates will be successful in higher education in related disciplines of biotechnology if pursued.

#### **IV.** Program Specific Outcomes (PSOs):

**PSO1: Research and Reasoning:** Identify, formulate, review literature, and analyze complex biotechnological problems reaching substantial conclusions using logical and critical thinking, and scientific principles.

**PSO2:Techno-Professional Efficiency:** Apply the understanding of multidisciplinary concepts of biotechnology with interdisciplinary approaches in the service of mankind.

**PSO3: Global Competency:** Demonstrate global competency in addressing interdisciplinary biotechnological issues through international certification courses.

#### V. Program Outcome (PO):

**PO1:** Biotechnological Knowledge: Apply the knowledge of basic sciences, classical and applied biological sciences, bioinformatics and biostatistics to address the challenges of biological sciences.

**PO2**: **Problem-Solving:** Ability to integrate multidisciplinary knowledge by applying problem-solving abilities in addressing challenges in biotechnological processes.

**PO3:** Analytical Processes and Instrumentation: Apply principles, analytical processes and standard methods of modern instrumentation in measurement and systematic analysis.

**PO4**: **Environment and Sustainability:** Understand the impact of biotechnological solutions in socio-economic and environmental contexts, and reconfigure it sustainable development.

**PO5:** Values and Ethics: Comply with values and professional ethics.

**PO6:** Individual and Teamwork: Demonstrate proficiency both as individual and a member/leader in diverse teams and multidisciplinary environments.

**PO7:** Communication: Proficient in conveying information, creating presentation and preparing reports for effective communication with both the scientific community and society.

**PO8:** Continual Learning: Engage in lifelong learning aligned with advance biotechnological fields.

#### VI. Total Credits to be Earned: 133

#### VII. Career Prospects:

Graduates with a B.Sc in Biotechnology have excellent career prospects in research, healthcare, pharmaceuticals, agriculture, and environmental science. They can become research scientists, lab technicians, clinical research associates, or agricultural biotechnologists, driving innovation in medical therapies, crop improvement, and sustainable environmental solutions.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers:**

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when,
1	Remember	where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The

Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weight age given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade **Grade Points Description** 10 O Outstanding 9 Excellent A+8 A Very Good B+7 Good В 6 Above Average C 5 Average P 4 Pass F 0 Fail 0 Absent Abs **UFM** 0 Unfair Means

**Table 2: Letter Grades and Grade Points** 

# iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### **D.** Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the

- respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned problem. The same has to be done in group so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social

interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

#### The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

#### Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file.

#### SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course								Maximum Marks for			
	11.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSBT1101R	Cell Biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSCH1101R	Basic Chemistry	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	3	24BSZO1101R	Animal Science	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
Semester I	4	24BSBT1102R	Biotechnology for Human Welfare	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
Š	5	24UBFS1101R	Basics of Statistics	MDC	3	0	0	0	0	0	3	40	60	0	100
	6	24UBPD1102R	Elementary English (CLPPD)	AEC	0	0	4	0	0	0	2	0	0	100	100
	7	24BSAG1101R	Agricultural Education	VAC	2	0	0	0	0	0	2	40	60	0	100
	8	24UBEC1101		Co/Extra- curricular	0	0	0	4	0	0	1	0	0	100	100
	Total									20				1100	

	S.	<b>Course Code</b>	Course Title	Course	F	ng	gag	ger	nei	nt		M	aximu	ım	
	No										Marks for		or		
				Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1	24BSBT1201R	Genetics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSFS1201R	Forensic Biology	DSC Minor	2	0	0	0	0	0	2	40	60	100	200
	3	24BSBT1202R	Human Disease Biology	DSC Minor	2	0	2	0	0	0	3	40	60	0	100
	4	24BSBT1203R	Biophysical chemistry	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	5	24BSAG1002R	Agricultural heritage	MDC	1	0	0	0	0	0		40	60	0	100
Semester	6	24BAPS1206R	Psychology of Happiness	MDC	2	0	0	0	0	0		60	40	0	100
mes	7	24UBPD1202R	Implicit English	AEC	0	0	4	0	0	0		0	0	100	100
Se	8	24UBES1101R	Environmental Studies	VAC	2	0	0	0	0	0		60	40	0	100
	9	24BSBT1204R	Design thinking and	SEC	0	0	2	0	0	0		0	0	100	100
			Entrepreneurship/Ideatio												
			n concept												
	10	24UBCC1201	CO Curricular Activities	Co and	0	0	0	4	0	0		0	0	100	100
				extra-											
				Curricular											
										21				1200	

	S.	Course Code	Course Title	Course	F	ng	gag	gen	nei	nt		M	[aximu	ım	
	No											M	larks f	or	
				Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1	24BSBT2101R	Biomolecules	DSC	3	0	2	0	0	0	4	40	60	100	200
				Major											
	2	24BSBT2102R	Microbiology	DSC	3	0	2	0	0	0	4	40	60	100	200
				Major											
	3	24BSZO2101R	Entomology	DSC	3	0	0	0	0	0	3	40	60	0	100
r III				Minor											
Semester	4	24BSBO2101R	Forestry	DSC	3	0	0	0	0	0	3	0	0	100	100
- me				Minor											
Š	5	24BSFD2001R	Basic of Food Science	DSC	2	0	0	0	0	0	2	0	0	100	100
				Minor											
	6	24BSCH2001R	Natural product chemistry	MDC	2	0	0	0	0	0		60	40	0	100
	7		PDP English Courses	AEC	0	0	4	0	0	0		0	0	100	100
	8	24BSBT2103R	Mushroom cultivation	SEC	0	0	4	0	0	0		60	40	100	200
	9	24BSBT2104R	Field Training	Field	0	0	0	4	0	0		0	0	100	100
				Training											
		'	Total								23				1400

	S.	('Ourca ('oda	Course Title	Course		En	ga	geı	ner	ıt		N N			
	No.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE *	PE*	Tota l
	1	24BSBT2201R	Enzymes and Metabolism	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Ţ	2	24BSBT2202R	Molecular Biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester	3	24BSBT2203R	Bioinstrumentatio n	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Se	4	24BSBT2204R	Immunology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	5		PDP English Course	AEC	0	0	4	0	0	0	2	0	0	100	100
	6	24UUFL202R	Financial Literacy	MDC	0	2	0	0	0	0	1	0	0	100	100
	7		Aptitude Course	SEC	0	0	0	8	0	0	2	0	0	100	100
	8	24UUHV2201 R	UHV	VAC	1	0	0	0	0	0	1	40	60		100
	9	9 BLSS		VAC	0	0	2	0	0	0	1	0	0	100	100
	Total									23				1200	

	S. No.	Course Code	Course Title	Course					ner	ıt		N	Iaxim Iarks	for	
	110.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSBT3101R	Plant Biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24BSBT3102R	Medical Biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester V	3	24BSBT3103R	Animal Biotechnology	DSC Major	3	0	2	0		0	4	40	60	100	200
me	4	24BSBT3104R	Bioinformatics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Sei	5		Logic Reasoning Course	SEC	0	0	0	8	0	0	2	60	40	100	100
	6	24BSBT3105R	Biofertilizer production	SEC	0	0	4	0		0	2	60	40	100	100
	7	24BSBT3106R	Summer Internship	Internship	0	0	0	0	0	24	4	0	0	100	100
	8	24BSBT3107R	Mini Research (R1)	Research/industry internship	0	0	0	0	12	0	2	0	0	100	100
		Tot	tal								26				1200
	S. No.	Course Code	Course Title	Course		En	ga	gei	ner	ıt			Iaximı Iarks		
	110.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24BSBT3201R	Industrial Biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester VI	2	24BSBT3102R	Agriculture Biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
semes	3	24BSBT3203R	Research Methodology	DSC Major	4	0	0	0	0	0	4	40	60	0	100
	4	24BSBT3204R	Food Biotechnology	DSC Major	4	0	2	0	0	0	4	40	60	100	200
	5	24BSBT3205R	Mini Research (R2)	Research	0	0	0	0	24	0	4	0	0	100	100
	(-3)									20				800	
	Total										133				6900

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

	SEMESTER – I											
Course Ti	tle	(	Cell Biol	ogy								
Course co	de 23BSBT111R	<b>Total credits: 4</b>	I		P	S	R	O/F	C			
		Total hours: 45T-		0	2	0	0	0	4			
Pre-requis		Co-requisite					Vil					
Programm		Bachelor of S										
Semester			of first year of the programme ents understand about the fundamentals and									
Course												
Objective		of cytology included cell cycle, cell divi	_									
		e knowledge and ski		•	_				•			
		e by observing them			_	tecin	nque	s, and	maerstand			
		ciency in laborator			•	nlv	nced	in ce	ll biology			
	_	cluding microscopy,	-	_		-						
CO1	Understand cellular											
CO2	Describe membrane											
	transportation.					P.	111	01				
CO3	Elaborate chromoso	mal structure and ty	pes.									
CO4	Understand the med	<u> </u>		nicatio	n.							
CO5	Describe the cell cy	cle and division in g	general ar	d in sc	me spe	cific	cell t	ypes.				
Unit-No.	Conte	nt	Contac	t	Learni	ing C	Outco	ome	KL			
			Hour									
I	Fundamentals of Ce	ell Biology: (Cell		Des	cribe,	illu	strat	e and	1			
	theory, Prokaryote an	d Eukaryote cell:		_			_	nizatio	1			
	Structure and Function	· · ·	7					microscopy 1,2				
	and Technique	of Cytology:	ogy: and structural differences.									
	(Microscopy and Stain											
II	Cell Membranes:				cribe,		strat					
	function; Cell junction		40					ructure				
	Transport proteins; M		10				_	nizatio	1			
	Membrane potential;	Transport across			•		s invo	olved ii	1			
TIT	plasma membrane.	halaar (Stanatuma)			sportati		strat		1			
III	<b>Chromosomes:</b> Morporganization: nucleo	osome, solenoid			cribe, lain			e and nosoma				
		centromere and	10		cture ar			1080111a	1,2			
	telomere); Types (spec			Suu	ciuic al	iu tyj	Jes.					
IV	Cell trafficking and			Des	cribe,	illn	strat	e and	1			
	signals; signalling path	0 0	_					nism o	f			
		phosphorylation;	8	_	to cell				1,2			
	Quorum sensing pheno											
V	Cell Division & Cell			Des	cribe,	illu	strat	e and	1			
	growth and differentia		10	exp	lain th	e cel	l cy	cle and	1 12			
	Stem cells, Germ ce	lls, Cancer cells,	10	divi	sion in	n ger	eral	and in	1,2			
	Apoptosis and Necrotic	c cell death		son	e speci	fic ce	ell ty	pes				
Practical			Describe, illustrate an									
	of various stages of Mitosis of give			_		_		staining				
	sample(s).		30					rry ou	t 1,2,3,4			
	2. Staining and microscopic observation		20	mic	roscopi	c exa	mina	ation.	1,2,5,4			
	of various stages in Meiosis of g											
	sample(s).											

#### **TEXT BOOKS:**

T1:Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002.

#### **REFERENCE BOOKS:**

R1: Cooper GM. The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates; 2000.

R2: Ambrose and Dorothy. Cell Biology. 2nd Edition. MEasty, ELBS Publications; 1970.

R3: Sharp, Lester W. Fundamentals of Cytology. 52th edition. Mc Graw Hill Company; 2011.

#### **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/books/NBK9839/?term=cell%20Biolpgy

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand cellular organization, functions, microscopy and structural differences.	1, 2, 3
2	Describe membrane structure, function, cell organization and the proteins involved in transportation.	1, 2, 3
3	Elaborate chromosomal structure and types.	1, 2, 3
4	Understand the mechanism of cell to cell communication.	1, 3
5	Describe the cell cycle and division in general and in some specific cell types.	1, 2, 3

			SEMESTER	<u> – I</u>							
Course	Title		General	Mici	robiol	ogy					
Course	code	23BSBT112R	Total credits: 4		L	T	P	S	R	O/F	C
			Total hours: 45T+30	OP	3	0	2	0	0	0	4
Pre-req		Nil	Co-requisite					N	il		
Progra			Bachelor of Scie				`				
Semes			Fall/ I semester of fin				_				
Cour			ne history, concept and	_	ortance	e of n	nicro	organ	isms ir	the fiel	d of
Object	ives		medical, agriculture et		. ,			1, 1		1.0	
		•	vledge and skills on va re and identification of			ımen	ts an	d tech	nıques	used for	r
CO	1	· ·	ntals of microbiology			tribu	tions	mad	o by	mont	minant
CO.		scientists.	itals of inicrobiology	anc	ı com	umu	110118	mau	с бу	many c	- IIIIII CIII
CO			n microscopes and thei	ir prii	ncinle	and	uses.				
CO			ge on the use of autocl						air flo	ow, mic	roscope
		and isolate microbe					,			,	Τ
CO			s of classification of mi	icroo	rganis	ms.					
CO			ds for culturing microo								
Unit-		Conte			ntact		Lea	rning	Outco	me	KL
No.				Н	our						
I	Fund	lamentals of Mi	crobiology: History			Des	scrib	e, fun	damer	ntals of	
	(Con	tributions of A.V.	Leeuwenhoek, Louis					ology		and	
		-	ister, and Alexander		7			tions	mac	•	1,2
			erms & Definition;		,	ma	ny er	ninent	scient	tists.	1,2
			ology; Branches of								
		obiology.									
II		oscopy: Simple,	compound, phase			Ab			escrib		
	contr	ast and electron mic	roscope.	]	10	_			oscope		1,2
***	3.5	1.175 1 .	C: 11: :: 0 C1:						and u		
III		-	Sterilization & filter				scrib lain	*	lustrate he		
	, ·		oclave, Hot air oven, filter, Sintered glass		basic						
			Chemical Methods:				hniqı Hiizə		such stainin	as as etc.,	
	1		enols, Halogens and	1	10					ological	
		· · · · · · · · · · · · · · · · · · ·	tion: UV rays and		10	stu		u III	Crook	nogicai	1,2
	Gami	-	ining Techniques:				) .				
		• //	ole Structural stains,								
	1	fast and Differential									
IV	Micr	obial Taxonomy: (	Concept of species &			Des	scrib	e, il	lustrat	e and	
	strain	s; classification	of bacteria; Typical			exp	lain	the	metho	ods of	
	bacte	rial cell (structure	& function; forms);			clas	ssific	ation,	str	ructures	
	Gran	n positive &	negative bacteria;		8	and	l fun	ctions	of a	typical	1,2
	Class	on serotyping and			bac	teria	l cell				
	nutrition of microbes; Microbes of extre										
V		uring microbes:	* *				scrib	_	lustrat		
	Isolation and screening; Growth curv				10	1 ^				reening	1,2
	Maintenance and preservation of microbi					and			uring	of	'-
cultures  Proof: 1 Laboratory Safety propagation for								ganisr		-	1.0
Practi		Laboratory Safety		3	30		scrib		lustrate		1,2,
cal		experiment, and	laboratory waste			exp	lain	a	nd	apply	3,4

management.	laboratory safe	ty rules, set
2. Principle, operation and	measurement of a mic	crobiological
pH of a given sample	experiment fo	r microbial
3. Principle and operation	of Hot air oven, isolation, prepa	are slides by
Autoclave, Laminar	airflow and applying	staining
centrifuge.	techniques ar	nd observe
4. Isolation of microbes fro	m given sample them under mic	croscope.
by serial dilution to	echniques and	
estimation of the CFU	Pour plate and	
streak plate techniques a	ilso be learned)	
Staining (gram, acid f	ast, endospore	
or any appropriate st	-	
given microbial		
	1	
observation under mici	oscope.	

#### **REFERENCE BOOKS:**

- R1. L.E.J.R. Casida. Industrial Microbiology. 2nd edition. New AGE International Publisher, 2019
- R2. P. S. Bisen. Fontiers in microbial technology. 1st edition. C.B.S. Publishers and Distributors; 1994
- R3. Alan T. Bull. Biotechnology: International Trends and Perspectives, Issue 7. Organisation for Economic Co-operation and Development, 1982.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/books/NBK7627/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe fundamentals of microbiology and contributions made	1, 2, 3
1	by many eminent scientists.	1, 2, 3
2	Describe and explain microscopes and their principle and uses.	1, 2, 3
2	Apply the knowledge on the use of autoclave, hot air oven,	1, 2, 3
3	laminar air flow, microscope and isolate microbes, and culture.	1, 2, 3
4	Explain the methods of classification of microorganisms.	1, 2, 3
5	Describe the methods for culturing microorganisms.	1, 2, 3

	SEMESTER – I													
<b>Course Title</b>		Bio	-Molecul	es										
Course code	23BSBT112R	Total credits: 4	L	T	P	S	R	O/F	C	,				
		Total hours: 45T+30	)P 3	0	2	0	0	0	4					
<b>Pre-requisite</b>	Nil	Co-requisite				Ni	l							
Programme		Bachelor of Sc	ience in I	Biote	chnolo	gy								
Semester		Fall/ I semester of f	irst year	of th	e prog	ramm	e							
Course	1. To impart	knowledge and unders	tanding o	n the	variou	is maci	ro-mole	cules	of life	÷,				
Objectives	their const	citution, classification, s	structure a	and f	unction	ıs.								
	methods.													
CO1	_	nderstanding of the stru	cture, fur	ctio	n and d	ifferen	tiation (	of the	types	of				
	DNA and RNA													
CO2		structure and correlate		perti	es, bio	logical	import	tance	and 1	the				
		cal tests for amino acid												
CO3		us levels of protein org												
CO4		of carbohydrate in tern	ns of its s	ructi	ure, cla	ssificat	tion, pro	perti	es and					
605	the laboratory qua		e structure, function and differentiation of the types											
CO5	Comprehensive ur lipids	nderstanding of the stru	cture, fur	ict101	n and d	ıfferen	tiation (	of the	types	of				
Unit-No.	C	ontent	Contac	t	Lear	ning O	utcome	e	KL					
			Hour											
I	Nucleic acid: S	tructure (Nitrogenous			escribe			and						
	bases, ribos	se, deoxyribose,			-		ructure							
		cleotides); glycosidic					cleic a							
	and phospo				cluding	g its	diffe	rent						
		formation, single letter	10	fo	orms.				1,2					
		Vatson-Crick Model;	10						1,2					
		Physical Properties;												
		l renaturation); RNA												
		Clover leaf model of												
	tRNA.			4_										
II	Amino acids	<i>'</i>				*	strate							
		Non-Essential amino	5		•		ructure		1,2					
	_	(physical, chemical		1 ~	-		mino a	cids						
***	& optical); Impor				nd class	•		1						
III		ification based on			escribe			and						
		proteins (keratins,		- 1			ructure	and						
		tin), globular proteins		II	ınction	oi pro	teins.							
	(hemoglobin,	myoglobin), metallo proteins,												
	lipoproteins,	* '	10						1,2					
		nd nucleoproteins]; position); Structure												
	1	position); Structure ndary, tertiary &												
		Denaturation and												
	renaturation; Fun													
IV	Carbohydrates:			P	escribe	;115	ctrate	and						
1 4	Isomerism, (D						ucture							
	, ,	ners, Mutarotation;	10		-		ohydra		1,2					
	_	(linear and cyclic).	10	11	aneu011	or cart	onyura	ics.	1,4					
		structure, occurrence,												
	Disaccitations (S	maciaic, occurrence,	l											

V	properties and functions); Cellulose (occurrence, structure, properties and functions); Heteropolysacchrides (occurrence, types, composition and function), Homopolysaccharides.  Lipids: fatty acids; glycerol; sphingosine; classifications; and characterization; Saponification and iodine number; Properties (glycerol, fats and oils); Properties and function (Phospholipids and Prostaglandins); Structure (sterols, Bile acids, steroid hormones, plant sterol, ergosterol, stigma sterol, cholesterol, glucocorticoid, mineralocorticoids); Lipoproteins (classification, composition and importance); Role of Lipids in cellular architecture and functions.	10	Describe, illustrate and explain the structure and function of lipids.	1,2
Practical	Qualitative analysis of Carbohydrate  1. Fehling's Test  2. Barfoed's Test  3. Molisch's Test  4. Benedict's test Qualitative analysis of proteins  5. Biuret Test  6. Xanthoproteic Test  7. Precipitation test  8. Heat and Acetic acid test Qualitative analysis of amino acids Ninhydrin Test	30	Describe, illustrate and explain apply qualitative analysis of carbohydrate, protein and amino acids.	1,2,3, 4

#### **REFERENCE BOOKS:**

- **R1**. David L. Nelson, Michael Cox. Menninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R2. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.
- R3. Voet and Voet. Biochemistry. 3rd edition. John Wiley & Sons, 2004.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/books/NBK545161/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Comprehensive understanding of the structure, function and differentiation of the types of DNA and RNA	1,2					
2	Demonstrate the structure and correlate its properties, biological importance and the qualitative analytical tests for amino acid.	1,2					
3	Describe the various levels of protein organization and the forces driving them	1,3					
4	Outline the basics of carbohydrate in terms of its structure, classification, properties and the laboratory qualitative tests.	1,2					
5	Comprehensive understanding of the structure, function and differentiation of the types of DNA and lipids	1,2					

	SEMESTER – I											
Course Title Basic Chemistry												
Cours	e code	23FSCH101R	Total credits: 2	L	T	P	S	R	O/F	C 2		
<b>D</b>	• • •	<b>3</b> 701	Total hours: 30T	2	0							
	quisite	Nil	Co-requisite	•	Nil							
	amme	Bachelor of Science in Biotechnology Fall/ I semester of first year of the programme										
Sem		1 To since the	knowledge about Chen									
Cou	irse ctives		etailed description of at							o it		
Object	cuves	1	wledge of classical and					шеот	es relateu t	ΟI		
			knowledge of the perio	•			•	3 theor	v			
C	<del>)</del>	_	der of the rate law e		_				<u>-</u>	e" and		
			lency of reaction rates u	•								
CO	)2		ots of electrochemistry,	_			•		oase, pH,	ouffers		
		and solubility	•									
CO	)3	Illustrate atomic st	tructure, Heisenberg U	ncerta	ainty	princip	ole, Qu	uantun	n mechani	cs and		
		Schrodinger wave e	•									
CO			pts of chemical bonding	_	_	_						
CO	)5	_	ent types of organic re	action	ns alo	ng wit	h thei	r mec	hanisms, o	organic		
** :	1	molecules and their	<u> </u>	T &		=				T		
Unit-		Conte	ent		tact	L	earnii	ng Out	tcome	KL		
No.	Chama	ical Vination Ond	ler-molecularity. First	Ho	our	Unda	rstand		م مادين م			
1			order rate equation,			conce		ι	inderlying of			
						ochem	istry	01				
	tempe	erature dependence of rate of reactions.			10		ochem	•	cells,	1,2		
									uffers and			
						solub		1 /				
II	Ionic	equilibrium: Elec	trolytic conductance,				rstand		atomic			
	Farada	ay's Law of elec	trolysis, Electrolytes,			struct	ure,	Н	Ieisenberg			
	1	is theory, Arrhenius theory for dissociation					rtainty		principle,			
		* *	rolytes, ionization constants of weak									
	1	and bases, pH, buffe	8			_		equation.	1,2			
	salt et	fects and solubility			To learn about the graphical representation of different							
									different different different			
									ed in the			
						orbita		1 IIII	ca iii tiie			
III	Atomi	ic Structure Reca	pitulation of Bohr's					the co	oncepts of			
			as, dual behaviour of						by using			
			deBroglie's relation,					_	periodic			
Heises new a Quant Schro terms their			principle. Need of a						tomic and			
		-	ic structure. What is						on Energy			
		rum mechanics,	Time independent					-	, Electro			
		Schrodinger equation and meaning of various			0	_			ements of	1,2		
			as (atomic orbitals) and			period	dic tab	le.				
			2s, 2p, 3s, 3p and 3d									
			representation) Rules									
		•	in various orbitals,									
		•	of the atoms. Stability									
	of ha	lit-filled and comp	oletely filled orbitals,									

	concept of exchange energy.			
IV	Chemical bonding- Various theories, covalent, hydrogen Bonding. Effective nuclear charge, atomic and ionic sizes. 6 Ionization energies, electron affinity and electro negativity, hard soft acids and bases.	10	Understand the different types of organic reactions along with their mechanisms. How to design syntheses of organic molecules. Acquire the knowledge of stereochemistry of organic molecules.	1,2
V	Organic Reactions and Stereochemistry: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule, Representations of 3 dimensional structures, structural isomers and stereo isomers. Configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.	10	Understand underlying concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility	1,2

#### **REFERENCE BOOKS:**

- R1. Graham Solomons. Solomons's Organic Chemistry, Global Edition. Wiley; 2017.
- R2. Bahl, Bahl. A Textbook Of Organic Chemistry. 22th Edition. S Chand Publishing; 2019.
- R3. Eliel and Wilen. Stereochemistry of Organic Compounds. 1st Edition. Wiley-Interscience. 1994.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5869253/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the order of the rate law equation, then characterize the "half-life" and temperature dependency of reaction rates using the Arrhenius equation.	1					
2	Explain the concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility	1,2					
3	Illustrate atomic structure, Heisenberg Uncertainty principle, Quantum mechanics and Schrodinger wave equation.	1					
4	Elucidate the concepts of chemical bonding, periodic properties.	1,2					
5	Explain the different types of organic reactions along with their mechanisms, organic molecules and their stereochemistry.	1,2					

			SEMESTE	CR – I						
Course	Title			Animal	Scien	ice				
Course	code	23FSZO101R	Total credits: 2	L	T	P	S	R	O/F	С
			Total hours: 30T	2	0	0	0	0	0	2
<b>Pre-requisite</b>		Nil	Co-requisite					il		
Program	nme		Bachelor of S							
Semes	ter		Fall/ I semester of							
Cour			e diversity, structu				on of	the a	nimal kin	gdom,
Object	ives		triploblastic coelom	•						
			life processes includ	_	oregu	ılation,	excre	tion, ne	eural condu	iction,
			egulation, and reprod							
			e relationships betw	een inse	ects a	nd mic	robes,	and ex	xplore inte	grated
			ement strategies.							
		_	e principles of ev				ty, an	d gen	etics, inc	luding
			and non-Mendelian i			tterns.				
CO			y species of animal k	_						
CO2			chemical processes of							
CO3		•	te phenomena of anii	•						
CO ₄			ion process, importar		odive	rsity h	otspot			
COS	,		enetics of living orga	anism						
Unit-		Conte	nt	Contac		Le	arning	g Outc	ome	KL
No.				Hour						
I		•	imal Kingdom:		Describe, illustrate and explain the basic concepts associated					
	_	loblastic coeloma	_					_		
		nals with mantle:		١.	with each system of the body					
	Anin		erocoel: Phylum			in vertebrates and				
		nodermata, Phylu			vertebi		.1			
	Phyl		5		•			nat are in	1,2	
		chordata, Subphylun		^				ystems to		
	_	olylum Vertebrata		^	perform the functions					
	_	atha, Class Cyclost		according to the habits of habitats of the animals.						
		thostomata, Class Pi	, .		l na	abitats	or the	anımaı	S.	
		bony fish), Class								
II	•	ilia, Class Aves, Cla processes Concepts				ogo <b>:1</b> .		trata =	ما مسامات	
11		excretion, Categor	•						nd explain ferent life	
		the basis of prir					_		regulation	
		etory products.	-						iology of	
		ation of urea, of	•			id Tep imal.	Todaci	.100 01	lology of	
		xification.Control			"	mma.				
Irrit		ability, Structure	·							
			ear. Conduction of							
	_	e impulse: Resting		6						1,2
		ntial and refractory	-							
	_	mission, Endoc								
		nones as chem	O							
1		back mechanisms	<b>O</b> ,							
1		etogenesis, structu	*							
		m of mammal. For								
	_	fertilization, ovipa								
		pu	<i>J</i> , P <i>J</i> and							1

	ovo-viviparity.			
III	Insect microbiology: Mutualistic associations between insects and microbes Insect nutrition and the importance of microbe's Fungal symbioses: Ant fungal gardens and termites Microorganisms and insect behavior. Insects as Vectors of Animal pathogens; Integrated pest management for vector control	5	Describe, illustrate and explain different types of associations of insects, insect behaviour and role of insect as a vector of various diseases.	1,2
IV	Evolution and Biodiversity: Evolution, Origin of life: Emergence of life on primitive earth, Evolution and adaptations: Microevolution, Role of Natural Selection in microevolution, Co-evolution. Ecological niches and adaptations. Biodiversity, Definition, Biodiversity hotspots, Benefits of Biodiversity, Biodiversity conservation, Bio- wealth of India. Human activities affecting biodiversity. Future of evolution.	7	Describe, illustrate and explain the evolution and diversity.	1,2
V	Genetics: Gene and gene concepts, Mendel an inheritance: Monohybrid and dihybrid cross, Concept of dominance. Exception to Mendel an inheritance: incomplete dominance, co- dominance; Interaction of genes: (Epistasis: recessive, dominant, double recessive and double dominant epistasis), lethal genes, Cytoplasmic inheritance: Kappa particles in Paramecium, sigma factor in Drosophila and shell coiling in Limnea. Introduction to human genetics: Mendel an phenotypic traits in humans: Dominant, recessive and X- linked characters (2 examples each), Pedigreeanalysis: Dominant, recessive and X- linked traits, Genetic counselling, Risk of inheriting a disease from consanguineous marriage.	7	Describe, illustrate and explain the classical genetics and learn about diseases associated with genetic disorder	1,2

## **Reference Books:**

- R1. Principles of Genetics by Snustad and Simmons (7thEdition) John Wiley and Sons, USA.
- **R2**: Textbook of physiology by Dr. A.K. Jain. (9thEdition). APSbooks.
- R3: EdwardO. Wilson, 1996, Biodiversity,521pp., National Academy Press.

#### OTHER LEARNING RESOURCES:

https://microbenotes.com/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Identify and classify species of animal kingdom.	1					
2	Explain various biochemical processes occurring in living being	1,2					
3	Explain and illustrate phenomena of animal reproductive biology	1					
4	Illustrate the evolution process, importance of biodiversity hotspot	1,2					
5	Describe classical genetics of living organism	1,2					

		SEMESTER	R – I						
Course Title	Elementary English								
Course code	23UBPD113R	<b>Total credits: 2</b>	L	T	P	S	R	O/F	C
		Total hours: 60P	0	0	4	0	0	0	2
Pre-requisite	Nil Co-requisite Nil								
Programme		Bachelor of Sc	ience	in Bio	techno	ology			
Semester	Fall/ I semester of first year of the programme								
Course	1. To recognize and identify parts of a sentence and their significance in								in a
Objectives	language.								
	2. To enhance listening and speaking/skills for self-development.								
	3. To give	insight into English	pron	unciat	ion an	d int	o cent	ral conce	pts in
	phonetics								
	4. Introduct	ion to the various mode	es of c	ommu	ınicatio	n will	enhan	ce their	
	knowledg	ge of communication.							
CO1	Equip students to re	ecognize and apply parts	of spec	ech, ar	ticles, a	nd aux	iliary v	erbs, and to	create
CO2	both affirmative and	d negative sentences.  pply determiners, form of	lifforon	t type	ofsent	ances	and co	mnrahand d	lagrage
COZ	of comparison.	ppry determiners, form c	minerem	i types	or sem	iences,	and co	inprenena c	iegrees
CO3	Prepare students to	confidently introduce th			e prope	r pron	unciatio	n, intonatio	on, and
G0.4		ely ask for and provide in				1 ,		• ,•	
CO4		p the communication particle p							
	communication.	mai and mioimai coi	mmami	zatron,	una	raciitii	y our	1015 10 01	iconvo
		key components of an	effect	ive pr	esentatio	on and	l how t	to use visu	al aids
TI '4 NI	proficiently.	Y 4		4 4	т	•	0 4		TZT
Unit-No.		Content		tact our	L	earnii	ng Out	come	KL
I	Basics of C	Grammar (Flipped	110	Jui	Stude	nts wi	11 dem	onstrate a	
-	classroom)	Tammai (Pripped						erstanding	
	i. Parts of Speed	ch					rules.	S	1 2
	ii. Articles		(	6					1,2,
	iii. Auxiliary Ve								
	iv. Affirmative Sentences	ve and Negative							
II		oped classroom)			Stude	nts	will	construct	
11	i. Determiners	speu classi oom j						rrect and	
	ii. Sentence Cor	nstruction	1,	6	_		nce typ		1,2,
		Sentences (Assertive,	'	U					3,4
	Imperative, etc.								
III	iv. Degree of Co Speaking Skills				Stude	nta v	vi11 o	onfidently	
111	i. Introduction a				introd		themse		
		n, Intonation, Stress		5	engag		in	basic	1,2,
		offering information						h correct	3
					pronu				
IV	Communicatio				Stude			effectively	
	i. Introduction to Communication communicate in both								
	ii. Process and Types of formal and informal settings							1 2	
	Communication, iii. Formal and informal 7 settings.							1,2,	
	communication								
	iv. Understan	ding Barriers to							
	Communication	C		ı					

#### **Textbooks:**

- 1.Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2.Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4.McDowell, GayleLaakmann.2008.Cracking the Coding Interview (Indian Edition)

#### **Reference Books:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2.Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3.Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- 4.Murphy, Raymond,.(2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English ,Cambridge University Press

#### OTHER LEARNING RESOURCES:

https://www.ef.com/wwen/english-resources/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Equip students to recognize and apply parts of speech, articles, and auxiliary verbs, and to create both affirmative and negative sentences.	1,7					
2	Teach students to apply determiners, form different types of sentences, and comprehend degrees of comparison.	1, 7					
3	Prepare students to confidently introduce themselves, use proper pronunciation, intonation, and stress, and effectively ask for and provide information.	1,7					
4	Help students grasp the communication process, differentiate between communication types, manage both formal and informal communication, and identify barriers to effective communication.	1,7					

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R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

## OTHER LEARNING RESOURCES:

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Demonstrate Enhanced Skill Proficiency	5, 6, 8				
2	Foster Personal Growth and Development	5, 6, 8				
3	Cultivate Ethical and Responsible Behaviour	5, 6, 8				
4	Promote Engagement and Commitment	5, 6, 8				
5	Enhance Social and Cultural Awareness	5, 6, 8				

			SEMESTE	R – I						
Course	Title		Co-Cu	rriculaı	· Acti	ivities				
Course	code	23UBEC111	<b>Total credits: 1</b>	L	T	P	S	R	O/F	C
			Total hours: 60P	0	0	0	4	0	0	1
Pre-req		Nil	Co-requisite				N:	il		
	Programme Bachelor of Science in Biotechnology  Semester Fall/ I semester of first year of the programme									
Seme		1 7							1 1	. 1 .
Cour			tain physical and mer		_					et best
Object	tives	_	ers for state, national a				-			: _
			nce and improve stude					•	yoga, musi	ic,
CO	\1		rama, etc through Adtl rn to work well with o							
								uer.		
CO			n to manage their time			-		. 11		
CO			ance their creative abi					cally.		
CO		-	prove their overall hea					tuila vata	maaitirvalry	
CO Unit-	<u>ა</u>	Conte	ome more aware of th	Conta			earning			KL
No.		Conte	ciit	Hou		L	earmin	g Out	come	KL
	comp are t within comm holist are	element academypically organizen educational nunities and placic development	and pursuits that ic learning. They zed and managed institutions or y a crucial role in s. Some examples			2.	such leader comm critica Holis Suppe	rship, nunica al thin	eamwork, ation, and	
	2. 3. 4. 5.		Clubs and Service and and Personal	60			devel along learni Build Creat oppor intera mento profes Perso Fulfil Provi for c expression along the state of the state	ng. ing N ing rtunition ors, ssiona nal lment ding reativ ssion, ring	nt academic letworks:  es to th peers, and ls.  : avenues ity, self-	1,2

R1: "Co-curricular Activities: A Pathway to Careers" by Ferguson.

R2: "Rahman, S.R., Islam, M.A., Akash, P.P., Parvin, M., Moon, N.N. and Nur, F.N., 2021. Effects of co-curricular activities on student's academic performance by machine learning. *Current Research in Behavioral Sciences*, 2, p.100057.

## **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students will learn to work well with others and communicate better.	5, 6, 7, 8				
2	Students will learn to manage their time and stay organized.	5, 6, 8				
3	Students will enhance their creative abilities and think more critically.	7,8				
4	Students will improve their overall health and reduce stress.	7,8				
5	Students will become more aware of their role in society and contribute positively.	6, 8				

		SEMESTER -	II					
Course Tit	•						_	
Course coo	de   23BSBT121R	Total credits: 4		T P	S	R	O/F	C
-		Total hours: 45T+30P	3	0 2	0	0	0	4
Pre-requisi		Co-requisite	. 5.			Vil		
Programn		Bachelor of Scien						
Semester		Fall/ II semester of fir					0	
Course		idents understand about e	•					*
Objective		ns, their role in regulating	•				energy	by
		protein metabolisms and for quantitative estimation	_	-	-		d aarbal	hardratas
	and extraction	s for qualititative estimation	OII OI DIN	A, KINA	, prote	ilis alic	ı carboi	nyurates
CO1		s, enzyme kinetics, includ	ling carbo	hvdrate	s and	nrotein	smetah	olism
CO2		ological roles of vitamins	_					
CO2		oppment of the human bod		erais and	ı men	contrib	oution 10	or overall
CO3		ration of cellular energy		ly throu	gh reg	ulation	of carl	ohvdrate
003	metabolism.	radon of centulal energy	iii oui oo	лу инои	gn reg	uiaiiUll	or care	onyurate
CO4		erconnection between pr	otein me	tabolish	n in o	ur hod	ly and	different
CO7	associated metabo	_	Stem inc			ai 000	., und	3111010111
CO5		ological effects of plant s	growth re	gulators	in plai	nt grow	vth and	
	development		5		•	J		
Unit-No.	Co	ntent	Contact	Contact Learning Ou			ome	KL
			Hour					
I	Enzyme: History,	Terminology, General		Able	to	des	scribe,	
	characteristics	Classification,		expla	in an	d illu	ıstrate	
		the enzymes te; ribozyme; Mechanism OF action Lock & key model; Induced fit model), the enzymes enzyme kinetics.					and	
						etics.		1,2
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		(Michaelis- Menten						
		ver Burk plot), Enzyme						
TT	(inhibition, specificit			411		1 .	.1	
II		Minerals: Definition;		1	to	_		
		classification; sources;	10	types	, so ions (	urces	and	1,2
	deficiency Disorder.				nineral		amms	
III		tabolism: Glycolysis,					and	
111	· ·	ruvate, TCA cycle,		illust		he pa		
	1.5	ogen, gluconeogenesis,		for		carboh	•	
		pathway, glyoxylate	10		bolism		·	1,2
		lrial electron transport,			nes inv			
	oxidative phosphory	_						
IV		sm- Degradation of		Able	to 6	explain	and	
		e, Non- Oxidative		1	rate t			
	deamination and dec	carboxylation of amino	10	for p	otein 1	netabo	lism	1,2
	acids, Urea Cyc	cle and Creatinine		and	the	enz	zymes	
	formation.			invol	ved.			
V	- C	regulators- Auxins,		Able	to un	derstar	nd the	
	•	nins. Abscisic acid and	15	_	growt	_		1,2
	•	nthesis- Structure of	13		heir fu		•	1,2
	photosynthetic app	aratus, C3 and C4		also	exp	olain	and	

	pathways, Light and Dark reaction, <b>Nitrogen metabolism</b> and fixation of nitrogen in leguminous plants.		illustrate CO2 and N2 Fixation.	
Practical	Quantitative estimation of Proteins (Lowry's method).     DNA (Diphenylamine method),     RNA (Orcinol method),     Amino acids (Ninhydrin reaction),     sugars (Dinitrosalicylic acid method)     Extraction of Protein from milk	30	Able to estimate the sugars, proteins, DNA,RNA and amino acids of given sample and extract protein from milk.	1,2,3,4

- R1. U Satyanarayana. Biochemistry. 13th edition. Elsevier Health Sciences; 2017.
- **R2**. David L. Nelson, Michael Cox. Lehninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R3. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4692135/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe enzymes, enzyme kinetics, including carbohydrates, and proteinsmetabolism.	1, 2,3					
2	Explain the physiological roles of vitamins and minerals and their contribution for overall growth and development of the human body.	1,2					
3	Describe the generation of cellular energy in our body through regulation of carbohydrate metabolism.	1, 2					
4	Illustrate the interconnection between protein metabolism in our body and different associated metabolic pathways.	1, 2,3					
5	Analyse the physiological effects of plant growth regulators in plant growth and development	1,2					

		SEMESTER	l – II						
Course Title			Genetics						
Course code	23BSBT122R	Total credits: 4	L	T	PS	R	O/F	C	
	2.44	Total hours: 45T+3	0P 3	0	2 0		0	4	
Pre-requisite	Nil	Co-requisite				Vil			
Programme	9,								
Semester	1 To formili	Fall/ II semester of	-	_	_		1	4:	
Course		arize with concepts of							
Objectives	mutation	f evolution because of	phenomen	on suci	i as iilika	ge and (	Crossin	ig over,	
		t skills through hands o	n practice t	for som	e of the o	observati	ional s	tudies	
	_	aryotyping and barr boo	_	or boin	e or the c	705 <b>01 va</b> t.	ionai s	taares	
CO1		e of genetic material a		l's law	s of inhe	eritance	and ca	auses of	
	variations.	C							
CO2	Explain the gen	etic mechanism of	sex deterr	ninatio	n and o	lynamic	struc	ture of	
	chromosomes.								
CO3	_	etic mechanism crossi	ng over th	at resu	ılts recor	nbinatio	n and	genetic	
	basis blood group								
CO4		etic material exchange		a throu	gh funda	mental	proces	ses like	
CO5		onjugation, and transdu		.414.1.	. :1:4 1	1'			
CO5	Analyze various nopulation.	nechanisms of mutation	ns and gene	etic stat	onity and	diversit	y in a		
Unit-No.		Content	Contact	L	earning (	Dutoom	0	KL	
Omt-140.		ontent	Hour		ai iiiig (	Juttom		KL	
I	Fundamentals	of Genetics: Scope;		A blo	to doo	cribe, a	and		
1	runuamentais	of Genetics: Scope,		AUIC	to des	cribe, a	and		
1		as genetic material,			ain genet				
1	DNA & RNA	•		expla		ic mate			
1	DNA & RNA Structure (DNA Laws (Domina	as genetic material, & RNA); Mendel's nce, Segregation &	15	expla	ain genet	ic mate		1.2	
1	DNA & RNA Structure (DNA Laws (Domina Independent As	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts	15	expla	ain genet	ic mate		1,2	
1	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross,	15	expla	ain genet	ic mate		1,2	
1	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dom	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts	15	expla	ain genet	ic mate		1,2	
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts otropy, Test cross, minance, Back cross	15	expla and i	ain genet ts implic	ic mate ations	rial	1,2	
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems) Sex Determ	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross	15	expla and i	ain genet its implic	ic materations	rial	1,2	
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila);	15	expla and i	ain genet ts implic	ic materations	rial	1,2	
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome,	as genetic material, a & RNA); Mendel's nce, Segregation & ssortment); Concepts etropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes;	15	expla and i	ain genet its implic	ic materations	rial	1,2	
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se	as genetic material,  & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes; x linked genes &		expla and i	ain genet its implic	ic materations	rial		
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen	as genetic material, a & RNA); Mendel's nce, Segregation & ssortment); Concepts etropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes;		expla and i	ain genet its implic	ic materations	rial		
	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.	as genetic material,  & RNA); Mendel's  nce, Segregation &  ssortment); Concepts  stropy, Test cross,  minance, Back cross  mination: (Plants,  nans, Drosophila);  Autosomes;  x linked genes &  asation of X- linked		Deve	elop und	derstand	rial		
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II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re	as genetic material, & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes; x linked genes & stropy and stropy are cross  Crossing Over:		Deve on se	elop und	derstand ination.	ing the and		
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (ma	as genetic material, a & RNA); Mendel's nce, Segregation & ssortment); Concepts otropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes; x linked genes & station of X- linked  Crossing Over: epulsion hypothesis;		Deve on se	elop und ex determine to ex	derstand ination.	ing the and use		
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (man Crossing or	as genetic material,  & RNA); Mendel's  nce, Segregation &  ssortment); Concepts  etropy, Test cross,  mination: (Plants,  nans, Drosophila);  Autosomes;  x linked genes &  asation of X- linked  Crossing Over:  epulsion hypothesis;  aize, drosophila);		Deve on se	elop und ex determine to expect to	derstand ination.	ing the and use		
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (material) Crossing of importance); che (linkage material)	as genetic material,  & RNA); Mendel's  nce, Segregation &  ssortment); Concepts  stropy, Test cross,  minance, Back cross  mination: (Plants,  nans, Drosophila);  Autosomes;  x linked genes &  stropy as a linked  Crossing Over:  epulsion hypothesis;  aize, drosophila);  ver (mechanism,  nromosome mapping,  apping, physical		Deve on se	elop und ex determine to experiment to	derstand ination.	ing the and use		
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (man Crossing or importance); ch (linkage man mapping),	as genetic material,  & RNA); Mendel's nce, Segregation & ssortment); Concepts tropy, Test cross, ninance, Back cross  nination: (Plants, nans, Drosophila); Autosomes; x linked genes & station of X- linked  Crossing Over: epulsion hypothesis; aize, drosophila); ver (mechanism, nromosome mapping, apping, physical gene interaction	10	Deve on se	elop und ex determine to experiment to	derstand ination.	ing the and use	1,2	
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (material) Crossing or importance); ch (linkage material) (supplementary	as genetic material,  & RNA); Mendel's  nce, Segregation &  ssortment); Concepts  tropy, Test cross,  minance, Back cross  mination: (Plants,  nans, Drosophila);  Autosomes;  x linked genes &  asation of X- linked  Crossing Over:  epulsion hypothesis;  aize, drosophila);  ver (mechanism,  nromosome mapping,  apping, physical  gene interaction  factors,	10	Deve on se	elop und ex determine to experiment to	derstand ination.	ing the and use	1,2	
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (may Crossing or importance); ch (linkage mapping), (supplementary complementary	as genetic material,  & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes; x linked genes & stropy are described by the content of X-linked  Crossing Over: epulsion hypothesis; aize, drosophila); ver (mechanism, mromosome mapping, apping, physical gene interaction factors, factors, multiple	10	Deve on se	elop und ex determine to experiment to	derstand ination.	ing the and use	1,2	
II	DNA & RNA Structure (DNA Laws (Domina Independent As (Alleles, Pleio Incomplete dor and problems)  Sex Determ animals, hun Chromosome, Allosomes; Se dosage compen genes.  Linkage and Coupling & re Linkage (may Crossing or importance); ch (linkage mapping), (supplementary complementary	as genetic material,  & RNA); Mendel's nce, Segregation & ssortment); Concepts stropy, Test cross, minance, Back cross  mination: (Plants, nans, Drosophila); Autosomes; x linked genes & station of X- linked  Crossing Over: epulsion hypothesis; aize, drosophila); ver (mechanism, mromosome mapping, apping, physical gene interaction factors, factors, multiple sis, allelism), blood	10	Deve on se	elop und ex determine to experiment to	derstand ination.	ing the and use	1,2	

IV	Cytoplasmic Inheritance: Chloroplast inheritance (Mirabilis); Mitochondria (yeast); kappa particles (paramecium); Bacterial Genetics: (Transformation, conjugation, Transduction)	10	Able to describe the extra-nuclear inheritance including bacterial genetics	1,2
V	Mutations: (Spontaneous; induced); Chromosomal mutation (deletions duplications, inversions), Trisomy and polyploidy. Aneuploids – Nullisomics, Monosomics, and uisomics); Population genetics (Mendelian population, Hardy Weinberg equilibrium, maintenance and establishment of equilibrium)	15	Able to describe the various phenomenon associated with chromosomal aberration and mutations.	1,2
Practical	<ol> <li>Preparation of buccal smear and observe the Barr bodies under a microscope,</li> <li>Chromosomal staining for the observation of karyotypes</li> <li>Practice on crosses based on Mendel's laws.</li> </ol>	30	able to analyse the chromosome associated with various genetic problems	1,2,3,4

- **R1**. Gupta. Genetics. 8th edition. Rastogi Publications; 2009.
- **R2**. Gardener et al. Principles of Genetics. 12th edition. Wiley; 2004.
- R3. Verma, Agarwal. Cell Biology, Genetics, Evolution & Ecology. 1st edition. S Chand Publication; 2006.

## **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/books/NBK115568/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe structure of genetic material and Mendel's laws of inheritance and causes of variations.	1,2					
2	Explain the genetic mechanism of sex determination and dynamic structure of chromosomes.	1,2					
3	Illustrate the genetic mechanism crossing over that results recombination and genetic basis blood grouping in human.	1,2,3					
4	Analyze the genetic material exchange in bacteria through fundamental processes like transformation, conjugation, and transduction.	1,2,3					
5	Analyze various mechanisms of mutations and genetic stability and diversity in a population.	1,2,3					

			SEMESTER -																																			
	e Title		Bioinstrumen	tation																																		
Cours	se code	23BSBT123R	Total credits: 4	L	T	P	S	R	O/F	C																												
D		NEL	Total hours: 45T+30P	3	0	2	0	0	0	4																												
	quisite	Nil	Co-requisite	aa in Dia	+00	hnology	Nil																															
	amme ester		Bachelor of Science Fall/ II semester of firs			O.																																
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	ctives		s chromatography, centrifi				• •																															
	ctives	radioisotopes and s	<b>U</b> 1 •	<i>agacien</i> , ,	801	creenop	110105	15, 010	······································																													
			s on operations of chroma	tography	, ce	entrifuga	tion, g	gel-ele	ctropho	resis																												
		and spectroscopic a	nalysis.						-																													
C	01	Describe all the	chromatographic techniq	ues and	l th	neir his	tory,	princi	ples, w	orking																												
		* * **	cations in various fields.																																			
CO	<b>D2</b>		ion, its principles, and its																																			
CO	03	<b>*</b>	techniques used in m			iology	techni	iques	such a	as gel																												
			measurement, dialysis, a		_																																	
CO	<b>D4</b>	_	iple, application of radio	isotope (	dati	ng and	mecha	anism	of radio	oactive																												
C(	) <u>-</u>	decay.		-4			1 41		1:4:.	:																												
CO	JS	1 -	ng principle of various spentration and molecular stru	•	01C I	netnoas	and ti	ieir ap	piicatio	ns in																												
Unit-		Cont		Contac	rt	Lea	rning	Outco	nme	KL																												
No.		Cont	CIIC	Hour		Lta	ımı	Oute	JIIIC																													
I	Chron	natography: Histor	y; Classification; Types,			Describ	e, illu	strate	and																													
			pplication & analysis			explain pH, buffers and																																
	(Paper	, Column, Adsorp	tion column, Partition,	15		related	theori	es		1,2																												
		•	ange, quantitative Ion			.5			1,2																													
		nge, and Gel																																				
		atography):				D '1	*11		1																													
II		rifugation: Types; Application; Principle;				Describ			and																													
		; density gradient & fugation.	10		explain quantum mechanics and the laws				1,2																													
	CCHILL	rugation.																																associa			iaws	
III	Gel	<b>Electrophoresis:</b>	Application; Types;			Describ			in the																													
		Principle; pH meter (Principle); Dialysis, <b>Blotting</b>				differer		_		1.0																												
	_	- '	stern, & Northern blot	10	forces for interaction		eractic		1,2																													
						molecu	le																															
IV		_	echnique: Introduction,			Describ																																
			rement of radioactivity,	10		explain				1,2																												
		otopes & radiati	on, units, radioactive			thermo	odynar	nics																														
V	decay.  C Spectroscopic techniques: Introduction,				Describ	برا ال	strata	and																														
·	_	ole and application of	•	1.5		explain				1.2																												
	Timen	ne and application (	л зреспозсору	15		protein			13111 01	1,2																												
Prac	Operat	ion of molecules fro	om given sample by			Able to																																
tical	-	or chromatography	om given sample by			instrum																																
icai	_	ımn chromatograph	V			mon will		or unu	-, 515																													
		n layer chromatogra	•	30						1,2																												
			protein molecules by																																			
		ctrophoresis	•																																			

- **R1.** Upadhyay. Biophysical chemistry: principle and technique. 12th edition. Himalaya Publishing House Pvt. Ltd; 2017.
- R2. Kakkar. Atomic and Molecular Spectroscopy. 1st edition. Cambridge English; 2017.
- R3. Evans. Handbook of Chromatography. 2nd Edition, Willford Press; 2019.

## OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/22274891/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe all the chromatographic techniques and their history, principles, working principle and applications in various fields.	1,2,3					
2	Explain centrifugation, its principles, and its diverse applications.	1,2,3					
3	Explain different techniques used in molecular biology techniques such as gel electrophoresis, pH measurement, dialysis, and blotting.	1,2,3					
4	Illustrate the principle, application of radioisotope dating and mechanism of radioactive decay.	1,2,3					
5	Analyze the working principle of various spectroscopic methods and their applications in determining concentration and molecular structure.	1,2,3					

			SEMESTER	l – II					
Course	Title	IMPLICATIVE	ENGLISH (Commun	icative	Engl	ish & Soft S	kills)		
Course	code	23UBPD123R	Total credits: 2	L	T	P S	R	O/F	C
			Total hours: 60	0	0	4 0	0	0	2
Pre-req	uisite	Nil	Co-requisite				Nil		
Prograi	mme		Bachelor of Sc	ience i	n Bio	technology			
Semes	ter		Fall/ II semester of	first ye	ear of	the progra	mme		
Cour	se	1. To introduce the	e types of sentences an	d their	signi	ficance.			
Object	ives	2. To strengthen th	ne vocabulary of the st	udents	to enl	hance stude	nt' vocal	oulary to	
		enhance their							
speaking and writing skills it the importance of dress codes in va							rious org	ganisations	<b>3.</b>
			e 3P's (Planning, prior						
CO			h the ability to transforn	n senten	ce typ	es, utilize di	ferent ter	nses, and ad	dress
		common grammatic							
CO2	2	_	proficiently apply one-						-
		and homophones, av vocabulary.	roid frequently confused	words,	and in	icorporate idi	oms and	pnrases in t	neir
CO3	l l		mprehending the various	s asnect	s and	types of liste	ning and	in identifyi	no and
			es to effective listening.	s aspect	o una	ey pes or note	iiiig, aiia	in racinity i	ng una
CO			n employing effective rea	ading st	rategi	es, extracting	relevant	information	n from
		texts, and utilizing tl	ne SQ3R method.						
CO		Instruct students on manage their time ef	the significance of time	manag	gemen	t and provide	e foundat	ional strate	gies to
CO		Lead students in cre-	ating a well-rounded and	l nrofes	sional	LinkedIn pro	file		
		Lead students in creating a well-rounded and professional LinkedIn profile.							
	, 							come	KL
Unit-		Conte		Cont	act		ing Out	come	KL
			ent		act			come	KL
Unit- No.	Gram	Conte	ent coom)	Cont	act	Students construct ar	will d transfo	accurately rm various	
Unit- No.	Gram i. Inte	Conte	ent coom)	Cont	act	Students construct ar sentence t	will ad transfo	accurately rm various	1,2,
Unit- No.	Gram i. Inte Senter ii. Typ	Conte	oom) tive and Assertive	Cont Hot	act	Students construct ar	will ad transfo	accurately rm various	
Unit- No. I	Gram i. Inte Senter ii. Typ iii. Co	Contentary (flipped classrestange of Interrogances, Exclamatory are oes of Tenses	oom) tive and Assertive and Assertive Sentences	Cont Hot	act	Students construct ar sentence t grammatica	will ad transfo ypes an l errors.	accurately rm various d correct	1,2,
Unit- No.	Gram i. Inte Senter ii. Typ iii. Co	Conte	oom) tive and Assertive and Assertive Sentences	Cont Hot	act	Students construct ar sentence t grammatica	will d transfo ypes and l errors.	accurately rm various d correct	1,2, 3
Unit- No. I	Gram i. Inte Senter ii. Typ iii. Co Vocal i. O	Contentary (flipped classrestange of Interrogances, Exclamatory are oes of Tenses	oom) tive and Assertive and Assertive Sentences	Cont Hot	act	Students construct ar sentence t grammatica	will d transfo ypes an l errors.	accurately rm various d correct ance their se words	1,2,
Unit- No. I	Gram i. Inte Senter ii. Typ iii. Co  Vocal i. O ii. H iii. W	Conte	oom) tive and Assertive and Assertive Sentences  t	Cont Hou	act	Students construct ar sentence t grammatica	will d transfo ypes an l errors.	accurately rm various d correct ance their se words	1,2, 3
Unit- No. I	i. Inte Senter ii. Tyr iii. Co Vocal i. O ii. H iii. W iv. Id	Conte	oom) tive and Assertive and Assertive Sentences  t	Cont Hou	act	Students construct ar sentence t grammatica  Students v vocabulary accurately i	will ad transfo ypes an l errors.  will enha and u n context	accurately rm various d correct ance their se words	1,2, 3
Unit- No. I	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id	Contentary (flipped classr rechange of Interrogances, Exclamatory are pess of Tenses ommon Errors bulary Developmentone word substitution omonyms and Home Vords often confused bioms and phrases in Skills	oom) tive and Assertive and Assertive Sentences  t	Cont Hou	act	Students construct ar sentence t grammatica  Students vocabulary accurately i	will ad transfo ypes and l errors.	accurately rm various d correct ance their se words .	1,2, 3
Unit- No. I	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id Lister i. Wha	Conto	oom) tive and Assertive and Assertive Sentences  t	Cont Hou	act	Students construct ar sentence t grammatica  Students v vocabulary accurately i	will d transfo ypes and l errors.  will enha and un context  will destening	accurately rm various d correct ance their se words .	1,2, 3
Unit- No. I	i. Inte Senter ii. Typ iii. Cc Vocal i. O ii. H iii. W iv. Id Lister i.Wha ii.Typ	Contentary (flipped classr rechange of Interrogances, Exclamatory are pess of Tenses ommon Errors bulary Developmentone word substitution omonyms and Home Vords often confused bioms and phrases in Skills	oom) tive and Assertive and Assertive Sentences  t	Cont Hor	act	Students construct ar sentence t grammatica  Students vocabulary accurately i	will d transfo ypes and l errors.  will enha and un context  will destening	accurately rm various d correct ance their se words .	1,2, 3
Unit- No. I	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id Lister i.Wha ii.Typ iii. Ur	contentary (flipped classer rechange of Interrogances, Exclamatory are pes of Tenses formon Errors for the word substitution omonyms and Home fords often confused from and phrases fing Skills to is listening?	oom) tive and Assertive and Assertive Sentences  t	Cont Hor	act	Students construct ar sentence t grammatica  Students vocabulary accurately i	will d transfo ypes and l errors.  will enha and un context  will destening ening bar	accurately rm various d correct ance their se words . emonstrate skills and riers.	1,2, 3
Unit- No. I	i. Inte Senter ii. Tyl iii. Co Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec	mar (flipped classr rehange of Interroga nees, Exclamatory are pes of Tenses ommon Errors bulary Developmen ne word substitution omonyms and Home fords often confused tioms and phrases ning Skills t is listening? es of Listening neerstanding Listening skills thinjues of Effective	oom) tive and Assertive and Assertive Sentences  t ophones  Barriers Reading	6 6 5 5	act	Students construct ar sentence t grammatical  Students vocabulary accurately i  Students effective liidentify list	will described with transform of the will enhand under the will described will described with the will describe with the will desc	accurately rm various d correct ance their se words	1,2, 3
Unit- No. I	Gram i. Inte Senter ii. Typ iii. Cc Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec ii. Gar	contains and the contains and phrases of Listening Skills the ring Skills the ring Skills the ring skills the ring ideas and infeature of Effective thering ideas and infeature of Listening ideas and infeature of Effective thering ideas and infeature of Listening ideas and List	oom) tive and Assertive and Assertive Sentences  t  pphones	Cont Hor	act	Students construct ar sentence t grammatical  Students vocabulary accurately i  Students effective lidentify lister  Students wand exinformation	will described with transform of the will enhand under the will described will described with the will describe with the will desc	accurately rm various d correct ance their se words	1,2, 3 1,2, 3
Unit-No. I II III	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec ii. Gat iii. Th	contentary (flipped classer rechange of Interrogances, Exclamatory and Des of Tenses ommon Errors bulary Development word substitution omonyms and Home Tords often confused dioms and phrases ining Skills to its listening? The set of Listening ing Skills the standard of Effective thering ideas and inform the SQ3R Technique	oom) tive and Assertive and Assertive Sentences  t  ophones  Reading ormation from a text	6 6 5 5	act	Students construct ar sentence t grammatical  Students vocabulary accurately i  Students effective lidentify lists  Students wand exinformation technique.	will described with transform of the will described with the will describe with the w	accurately rm various d correct ance their se words	1,2, 3 1,2, 3
Unit- No. I	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec ii. Gar iii. Th	conto	oom) tive and Assertive and Assertive Sentences  t ophones  Reading ormation from a text	6 6 5 5	act	Students construct ar sentence t grammatical  Students v vocabulary accurately i   Students effective lidentify lister students w and exinformation technique.	will destruction will destruct with the destruction will destruct will destruct will destruct with the destruction will be destructed with the	accurately rm various d correct ance their se words	1,2, 3  1,2, 3  1,2, 3
Unit-No. I II III	Gram i. Inte Senter ii. Typ iii. Cc Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec ii. Gat iii. Th Time- i. Intro	container (flipped classer rechange of Interrogances, Exclamatory are personal of Tenses of United States of Tenses	ent  oom) tive and Assertive and Assertive Sentences  t  ophones  Reading ormation from a text  anagement	6 6 5 5	act	Students construct ar sentence t grammatical Students vocabulary accurately i Students effective li identify liste Students wand exinformation technique.	will deprivation will described with the will described will read extract using will their time.	accurately rm various d correct ance their se words	1,2, 3 1,2, 3
Unit-No. I II III	i. Inte Senter ii. Typ iii. Cc Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi ii. Tec ii. Gat iii. Th	contentary (flipped classer rechange of Interrogances, Exclamatory and Description of Tenses of Listening of Tenses	ent  oom) tive and Assertive and Assertive Sentences  t  ophones  Reading ormation from a text  anagement	6 6 5 5	act	Students construct ar sentence t grammatical Students vocabulary accurately i Students effective li identify liste Students wand exinformation technique.	will deprivation will described with the will described will read extract using will their time.	accurately rm various d correct ance their se words	1,2, 3  1,2, 3  1,2, 3
Unit-No. I II III	i. Inte Senter ii. Typ iii. Co Vocal i. O ii. H iii. W iv. Id Lister i. Wha ii. Typ iii. Ur Readi i. Tec ii. Gar iii. Th Time- i. Intro	container (flipped classer rechange of Interrogances, Exclamatory are personal of Tenses of United States of Tenses	ent  oom) tive and Assertive and Assertive Sentences  t  ophones  Reading ormation from a text  anagement e of Time	6 6 5 5	act	Students construct ar sentence t grammatical Students vocabulary accurately i Students effective li identify liste Students wand exinformation technique.	will deprivation will described with the will described will read extract using will their time.	accurately rm various d correct ance their se words	1,2, 3  1,2, 3  1,2, 3

## **Textbooks:**

- 1.Barrett, Grant.2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2.Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.

- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4.McDowell, GayleLaakmann.2008. Cracking the Coding Interview(Indian Edition)

#### **Reference Books:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- 4. Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### **OTHER LEARNING RESOURCES:**

https://www.ef.com/wwen/english-resources/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Provide students with the ability to transform sentence types, utilize different tenses, and address common grammatical mistakes.	1,7
2	Empower students to proficiently apply one-word substitutions, differentiate between homonyms and homophones, avoid frequently confused words, and incorporate idioms and phrases in their vocabulary.	1,7
3	Assist students in comprehending the various aspects and types of listening, and in identifying and overcoming obstacles to effective listening.	1,7
4	Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.	1,7
5	Instruct students on the significance of time management and provide foundational strategies to manage their time efficiently.	1,7
6	Lead students in creating a well-rounded and professional LinkedIn profile.	1,7

SEMESTER – II											
Course			Environi	nental (	Scien	ce					
Course	code	23UBES101R	Total credits: 2	L	T	P	S	R	O/F	C	
			Total hours: 30	2	0	2	0	0	0	2	
Pre-req		Nil	Co-requisite				N	<u>il</u>			
Progra			Bachelor of S								
Semes			Fall/ II semester o								
Cour			lents for careers as lea				_		-	lex	
Object			ues from a problem-c			•	• •	•			
		_	orld population that i								
			problems and which			_					
			to work individually a vention of new ones.	and con	ecuve	ery towa	arus sc	nunons	s of current	L.	
CO			be able to appreciate	the ethi	cal c	rocc cu	ltural	and his	etorical cor	ntevt	
		of	be able to appreciate	the cum	cai, c	1055-Cu	iturai,	and m	storical col	πικ	
			ues and the links bety	ween hu	man a	and nati	ıral sv	stems			
CO			n about natural resour						ental impac	ets of	
			on natural resource	, 1					put	~.	
CO			about environment ar	nd ecosy	stem	, Stude	nts wil	l be ab	ole to unde	rstand	
		_	diversity and respect								
CO	4	Gain knowledge a	about the conservation	n of bio	divers	sity and	its im	portan	ce.		
CO	5	Aware students a	bout problems of en	vironm	ental	pollutio	on, its	impac	t on huma	n and	
		ecosystem and co	ntrol measures.								
Unit-		Conte	nt	Cont	act	L	earnir	ıg Out	come	KL	
No.				Hou	ır						
I		disciplinary natu				Enviro			studies		
			Definition, scope						to tackle		
		nportance, Need fo	or public			enviro			sues. Its		
	aware	ness.		4		multid	•	•	approach	1,2	
								_	complex		
						problems. Public awareness and education are vital for					
								ustaina			
II	Natur	al Resources: Re	enewable and non-			Natura		esource			
			Natural resources			renew		and	,		
			s. Forest resources:						ploitation		
		•	tion, deforestation,			issues			including		
		_	extraction, mining,			defore	station	ı, ov	eruse of		
	dams	and their effects	on forest and tribal			water			resources,		
	people	e. Water resource	es: Use and over-			enviro	nment	al c	challenges		
	utiliza	ation of surface	and ground water,			with r	ninera	ls and	food, and		
		-	s over water, dams-	6		land			gradation.	1,2	
		•	Mineral resources:	Ü					a crucial	1,2	
		-	vironmental effects				cons	_	resources		
			mineral resources,			and	1	_	promoting		
			ources: World food			sustair	nabilit	у.			
	_		sed by agriculture								
			fects of modern								
	_	logging, salini	esticide problems, ty, case studies.								
	Energ	y resources: Grov	wing energy needs,								

	renewable and non-renewable energy sources, use of alternate energy sources.  Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.  Role of an individual in conservation of natural resources. Equitable use of			
III	resources for sustainable lifestyles  Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological		This module covers ecosystems, including their concept, structure, functioning, and diversity.	
	succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the Following ecosystem: - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	4	Students will learn about energy flow, ecological succession, and various ecosystem types like forests, grasslands, deserts, and aquatic ecosystems.	1,2
IV	Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega diversity nation• Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.	5	This module covers biodiversity, including its definition, value, levels, and threats. Students will learn about India's biogeographical classification, its status as a mega diversity nation, and key biodiversity hotspots. They'll also explore threats like habitat loss, wildlife poaching, and human-wildlife conflicts, crucial for conservation efforts.	1,2
V	Environmental Pollution: Definition Cause, effects and control measures of:-Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste, Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.	5	This module covers environmental pollution, including causes, effects, and control measures, alongside waste management and disaster preparedness strategies.	1,2
VI	Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and	6	This module explores social- environmental dynamics, including urban energy challenges, water conservation, and	1,2

	rehabilitation of people; its problems and concerns. Case Studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Waste land reclamation. Consumerism and waste products. Environment  Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Issues involved in enforcement of environmental legislation. Public awareness.		resettlement issues. It delves into environmental ethics, climate change impacts, and relevant legislation like the Environment Protection Act, emphasizing public awareness and enforcement challenges.	
VIII	Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.  Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain.  Visit to a local polluted site- Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds.  Study of simple ecosystems-pond, river, hill slopes, etc.  (Field work Equal to 5 lecture hours)	5	This module covers human population dynamics, including growth, impact on the environment and health, along with initiatives like Family Welfare Programs and the role of information technology, illustrated with case studies.  Fieldwork objectives include documenting environmental assets like rivers and forests, assessing pollution in urban or rural sites, and studying local biodiversity and ecosystems such as ponds and hill slopes	1,2

R1. Bharucha. Textbook of Environmental Studies for Undergraduate Courses. 2nd edition. Orient Black swan Publishing; 2019.

R2Trivedy Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media(R). B.S. Publications; 2010.

R3. Trivedi, Goel. Introduction to air pollution. 1st publication. Techno-Science Publication (TB); 2003.

#### **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/22274891/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	The students will be able to appreciate the ethical, cross- cultural, and historical context of environmental issues and the links between human and natural systems.	1, 4
2	Students will learn about natural resource, its importance and environmental impacts of Human activities on natural resource	1,4
3	Gain knowledge about environment and ecosystem, Students will be able to understand the concept of biodiversity and respect them	1, 4
4	Gain knowledge about the conservation of biodiversity and its importance.	1, 4
5	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.	1, 2, 4

			SEMESTER	– II						
Course '	Title		Extra-Cur	ricula	r Act	ivities				
Course	code	23UBEC121	Total credits: 1	L	T	P	S	R	O/F	С
			Total hours: 60P	0	0	0	4	0	0	1
Pre-requ	iisite	Nil	Co-requisite		•	•	N	il		
Program	nme		Bachelor of Scientific Scientific Bachelor of Bachelo	ence i	n Bio	techno	logy			
Semes	ter		Fall/ I semester of fir	•						
Cour	se		in physical and menta		_				and selec	t best
Objecti	ives		for state, national and				•			
			e and improve student's				_	-	ga, music	,
			na, etc through AdtU c							
CO1			be various sports, mus						available	at the
			lain the benefits of part	•						
CO2			techniques learned in		_				_	_
		effectively in sports, music, and other co-curricular competitions, and analyze their								
		Γ	ntify areas of improven							
CO3			etive essay or present			_				
			ibuted to their personal	and 1	orofes	sional g	growth	i, and o	design a pl	an for
	1		and skill development.	T ~		_				
Unit-		Cont	tent	1	ıtact	L	earnii	ng Out	come	KL
No.	D	1 .1 1		Н	our	G: 1		.11 1	.1	
I			's interest they can			Stude			nave the	
	•	•	sports, music, and co-				•		plore and	
		•	ning the clubs of the				•		erests by	
		• ` `	Footshal; Cricket; ll; Badminton; Table			sports	•	-	variety of and co-	
		<b>O</b> '					*	usic, ctivitie:		
		*	ner outdoor and indoor			curric	uiar ac	cuvine	S	
	_		Vocals; Photography;	6	50					1,2
		•	ies); The students are							
			pate in regular club competitions as per							
		_	ies; Renowned skilled							
		essionals/ person	*							
	_	-	to promote the talents							
	_	e students.	o promote the talents							
	or un	e students.								

R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

# OTHER LEARNING RESOURCES:

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extracurricular-activities}$ 

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Identify and describe various sports, music, and co-curricular activities available at the university, and explain the benefits of participating in these activities.	5, 6, 8
2	Apply skills and techniques learned in workshops and club activities to participate effectively in sports, music, and other co-curricular competitions, and analyze their performance to identify areas of improvement.	5, 6, 8
3	Discuss the reflective essay or presentation assessing how involvement in various activities has contributed to their personal and professional growth, and design a plan for future engagement and skill development.	5, 6, 8

SEMESTER – II									
Course Title	e	Co-Curr	icula	r Acti	vities				
Course code	e <b>23UBEC111</b>	Total credits: 1	L	T	P	S	R	O/F	C
		Total hours: 60	0	0	0	4	0	0	1
Pre-requisit		Co-requisite				Ni	il		
Programme	2	Bachelor of Sc							
Semester		Fall/ I semester of f							
Course		tain physical and ment		_					t best
Objectives		rs for state, national and				-			
		ce and improve student					_	yoga, musi	c,
CO1		ama, etc through AdtU  n to work well with oth							
							ier.		
CO2		n to manage their time					11		
CO3		ance their creative abili					ally.		
CO4	_	rove their overall healt					miles-4		
CO5 Unit-	Students will beco	ome more aware of the		in soc			ribute		KL
No.	Cont	ent		our	L	earnn	ig Out	come	KL
	-curricular activit	ies cover a wide	110	Jui	5	Ski	11		
con typ edu and	mplement academic pically organized a acational institution of play a crucial velopment. Some ex- 7. Sports and Phy 8. Cultural Activ	ysical Activities ities: bs and Competitions ervice and d Personal	•	50	7.	Enhauch lead com and thin Hol Sup emo and dev alor acade lear Bui Net Cre opp interpretain Personal Pe	lership muni- iking. istic portiona- elopm ngside demic ming. lding works ating ortuni- eract rs, profe sonal fillme- viding	g skills camwork, o, cation, critical  Growth: ag l, social, physical cent  ties to with mentors, ssionals.  nt: g avenues creativity,	1,2

R1: "Co-curricular Activities: A Pathway to Careers" by Ferguson.

R2: "Rahman, S.R., Islam, M.A., Akash, P.P., Parvin, M., Moon, N.N. and Nur, F.N., 2021. Effects of co-curricular activities on student's academic performance by machine learning. *Current Research in Behavioral Sciences*, 2, p.100057.

#### OTHER LEARNING RESOURCES:

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extracurricular-activities}$ 

	CO PO Mapping					
SN	Course Outcome (CO)	<b>Mapped Program Outcome</b>				
1	Students will learn to work well with others and communicate	2, 6, 8				
	better.	· ,				
2	Students will learn to manage their time and stay organized.	2, 6, 8				
3	Students will enhance their creative abilities and think more	2, 6, 8				
	critically.	=, 0, 0				
4	Students will improve their overall health and reduce stress.	2, 6, 8				
5	Students will become more aware of their role in society and	2, 6, 8				
	contribute positively.	2, 0, 0				

		SEMESTER – III								
Course Tit	le	Immuno	ology							
Course cod	le 23BSB211R	<b>Total credits: 4</b>	L	T	P	S	R	O/F	С	
		Total hours: 45T + 6	60P 3	0	2	0	0	0	4	
Pre-requisi	te Nil	Co-requisite			Nil					
Programm		<b>Bachelor of Science</b> i		n Biotechnology						
Semester		III semester of first y								
Course		students immunology		ity, ar	ntigen	n, anti	body,	cytok	tines,	
Objectives interleukinc, vaccines and autoimmunity.  2. To explain the components of immune systems, antigen antibody reaction,					ion					
	_	iques like RIA and EL	•	_		-			ions.	
601	Describe the general intro	-					_			
CO1	involved in it.									
CO2	Discuss the mechanism o	f immune system.								
CO3	Demonstrate and analyse	various immune based	d experin	nents ı	ısing	RIA,	ELIS	A		
CO 4	Apply the concepts and t									
CO 5	Illustrate the types and fo	orms of auto immune d	liseases.							
Unit-No.	Conten	t	Contac	t I	Leari	ning C	<b>utco</b>	me	KL	
			Hour							
I	Introduction to Immuno		8			ibe, ill		te		
	system; Natural & acquire					xplain ne sys		ınd	1,2	
	General properties of immune responses: immune system  Cells, tissues and organ of immune system its component									
II	Immunity: Acquired, Inna	nte, Cell mediated &	10			ibe,				
	humoral Immunity; T				ınd	:4	expl			
	activation, maturation.  antibody: structure, fund	Antigen and			mmu ınd	nity,	antiş antibo	_	1,2	
	Antigenicity and immun					ctions	antio			
	antibody interactions									
III	Cytokines and chem families, cytokine antagon	okine: properties,			Descr ind	ibe,	illustı expl	I		
	disease, Immunogenicity. 1				ina Cytok	ines	•	and	1,2	
						eukins				
IV	Protective Immunity: a	-	10			ibe,				
	immunization; conjugate vaccine; adjuvants; rec				ınd liffer	ant 1	expl		1.2	
	DNA vaccine.	ombinant vaccine;			accii		ype	of and	1,2	
						nations				
V	1	immune diseases,	10			ibe,				
	factors contributing devi immune diseases, mechani				ınd toir	nmuni	expl	ain and		
	breakdown of self-toler	-				mmun	-	and	1.0	
	transplants, molecular mi				liseas				1,2	
		mmune diseases,								
	eplacement therapy, autoimmune processes, tra	suppression of								
Practical	Precipitation Reaction:	nspianiations	60	-	Able	to	opeı	rate		
	i. Double Diffusion		00			4, RI <i>A</i>			1,2,	
	ii. Single Diffusion R								3,4	
	iii. Ouchterlony immu iv. Immunoelectrodiff								-,.	
	iv. Immunoelectrodiff	1051011								

88	and		
quantitative)			
WIDAL, ASO, VDRL, RPR, CRP			
Blood grouping and Rh typing, ELISA			

- R1. Abbas. Cellular and Molecular Immunology. 10th edition. Elsevier; 2021.
- **R2**. Martin et al. Roitt's Essential Immunology (Essentials). 13th edition. Wiley-Blackwell, 2017.
- **R3**. Westwood. Practical Immunology. 4th edition. Wiley-Blackwell; 2002.

# OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6156898/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1.	Describe the general introduction of immunology and the various cells and organ involved in it.	1, 2							
2.	Discuss the mechanism of immune system.	1, 2							
3.	Demonstrate and analyse various immune based experiments using RIA, ELISA	1, 2, 3							
4.	Apply the concepts and types of vaccines and immunization process.	2, 3							
5.	Illustrate the types and forms of auto immune diseases.	1, 2							

		SEMESTER – III	[									
Course Title		Molecula	r Biology	y								
Course code	23BSBT212R	Total credits: 4	L	T	P	S	R	O/F	'	C		
		Total hours: 45T + 60P	3	0	2	0	0	0		4		
Pre-requisite	Nil	Co-requisite				Nil						
Programme		Bachelor of Scienc										
Semester	1	Fall/ II semester of first		_	_							
Course		e basic concept of genom	e organis	atıor	and l	Nucle	eic aci	d, ope	eror	1		
Objectives	1	oliday model.	1 . "1									
CO 1		e central dogma of life in		1.0								
CO 1	1 -	ration of genome, its comp	-									
CO 2		ss of replication, transcrip			and p	rote	n synt	hesis				
CO 3		repair mechanism and tra	_		•	1.1						
CO 4		ge of genomic and plasmi	id DNA i	solat	ion ar	id the	ır pol	ymorį	ohis	m		
CO 5		ode, Wobble hypothesis.		, 1 -	r	• ~						
Unit-No.	(	Content	Contac Hour		Learn			me	K	L		
I	eukaryote genome value paradox; ge semi conservati replication; DNA (Cot curve anal- sequences (satelli- etc); DNA meltin neucleosome phase	re-association kinetics ysis); repetitive DNA te DNA, LINE, SINE g and buoyant density; sing.	8	1	Under blueprand its	rint of	f life etion		1	,2		
II	Replication initi termination in eukaryotes, Hom at the molecular	ation, elongation and prokaryotes and cologous recombination level: Holliday model, reak repair model	8	]	Descriand exproces replication	xplain ss of l ation	the DNA and	te	1	,2		
III	Nonsense, missen Intragenic and Frameshift mutati and biological mu Transposable g prokaryotes and e of transposition, mutation, Base	sion repair, Mismatch	8	1	Describe, illustrate and explain the process of DNA damage and repair mechanisms.			and explain the process of DNA damage and repair mechanisms.			1	,2
IV V	Prokaryotic & En Post Transcription Processing of hal Cap formation, polyadenylation, nuclear export of Translation ma	alkaryotic Transcription. nal Modifications: RNA, tRNA, rRNA, 5'- 3'-end processing and splicing, RNA editing, mRNA, mRNA stability achinery, Ribosomes,	8	3 1 0 1	Descriand exproces transcrediting RNAs	splains of ription of vibe, il	the n and ariou	s		,2		
	Composition and	d assembly, Universal		1	and ex	kplain	the		1	,2		

	genetic code, Degeneracy of codons, Termination codons, Isoaccepting tRNA, Wobble hypothesis, Mechanism of initiation, elongation and termination, Co- and post-translational modifications, Genomics and proteomics		translation machineries and mechanisms	
Practical	<ol> <li>Isolation of plasmid/ genomic DNA of bacteria/ Plant/ Animal cell sample.</li> <li>PCR amplification of selected genes</li> <li>Separation of DNA molecules using gel electrophoresis</li> <li>RFLP of PCR amplicons/ DNA typing by RAPD.</li> </ol>	60	Able to isolate DNA, amplify and separate them and analyse them by RFLP or RAPD techniques	1,2,3,4

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1.	Explain the organization of genome, its components and functions.	1, 2							
2.	Describe the process of replication, transcription, splicing, and protein synthesis	1, 2							
3.	Describe the DNA repair mechanism and transposition.	1, 2							
4.	Apply the knowledge of genomic and plasmid DNA isolation and their polymorphism	1, 2, 3							
5.	Illustrate genetic code, Wobble hypothesis.	1, 2							

			SEMESTER -	III								
Course Ti	itle		Genetic	c Engine	ering							
Course co	de	23BSB213R	Total credits:3	L	T	P	S	R	O/I	F	C	
			Total hours: 45T+30	P 3	0	2	0	0	0		4	
Pre-requis		Nil	Co-requisite				Ni	l				
Programi			Bachelor of Sci			`						
Semeste			Fall/ III semester of f									
Course			arize the molecular and									
Objectiv	es	genetic m products.	aterial and techniques	tor modif	yıng	organı	sms to	produ	ce des	sire	d	
			nd manage formulation	n and exe	cution	of pro	otocols	s and i	nnova	tive	3	
			gies and/or products.									
		3. To expose	e students to various te	chniques	to en	hance o	organi	sms so	that t	hey	are	
		better able	e to thrive in certain en	vironmen	ıts.							
CO1		Explain the conce	pts of genetic engineer	ing								
CO2		Explain cloning to	echniques and the types	S.								
CO3			onstrate molecular dete		hods							
CO4			lications of recombinar			logy.						
CO5		Apply the method	ls of disease detection u	ising mol	ecula	r techr	iques.					
Unit-No.		Con	tent	Contac	t	Learning Outcome				K	L	
				Hour								
I	Int	roduction to Go	enetic Engineering:	8	U	Inderst	and th	e				
			nd scope. Restriction			oncept	_	enetic		1	,2	
		•	characteristics and		e	nginee	ring			-	,_	
II	use		a vootonsi nlosmid	10 Describe and illustra				Ilmatea	ıto.			
11		oning and cloning vectors:       plasmid       10       Describe and illustrate cloning techniques         etors, λ vectors.       Construction and       cloning techniques					iie		_			
		reening of genomic DNA library and						1	,2			
	1	NA library										
III	1	lecular detec		8		escrib			ınd			
	1	thern, Norther				xplain			.			
			erase chain reaction Fragment Length			etectio nethods		analys	1S			
		ymorphism(RFLP			11	letilous	5			1	,2	
			ohic DNA (RAPD),							-	,_	
	1	A finger printing	, , , ,									
		•	eoxy and chemical									
***		uencing methods	C D 1:	10		1	***					
IV			n of Recombinant gineering of bacteria,	10		escrib	-					
			d biopharmaceuticals			xplain f recor						
		sulin and grow				chnolo		II D1 1/2	`	1	,2	
			technology, Vaccine				83					
		duction										
Sic			of disease: AIDS,	10		escrib				1		
			nia, cystic fibrosis,			xplain				1	,2	
	Du	chenne muscular d	уѕігорпу			or disea sing m			l			
Practical	Isol	ation of DNA f	rom various sources,	60		ble to						
			noresis, SDS PAGE,			nethods			,	1 2	2 1	
			tion of DNA & RNA			f DNA		-		1,2	,3,4	
	by U	JV Spectrophotom	netry		P	roteins	\$					

- R1. Primrose S.B. et al. Principles of Gene Manipulation. 6th Edition. John Wiley Blackwell; 2001.
- **R2**. Watson J. D. et al. Molecular Biology of the Gene. 7th edition. Pearson; 2013.
- **R3**. Brown. T. A. Gene Cloning and DNA Analysis: an introduction. 7th edition. JOHN WILEY; 2016.

## **OTHER LEARNING RESOURCES:**

https://www.annualreviews.org/doi/abs/10.1146/annurev-arplant-042809-112116

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the concepts of genetic engineering	1, 2
2	Explain cloning techniques and the types.	1, 2, 3
3	Explain and demonstrate molecular detection methods	1, 2, 3
4	Describe the applications of recombinant DNA technology.	1, 2, 3
5	Apply the methods of disease detection using molecular techniques.	1, 2, 3

			SEMESTER-	III								
Cours	se Title		English Lang	uage	for Ex	celle	ence					
Cour	se code	23UBPD212R	Total credits: 2	L	T	P	S	R	O/F	C		
			Total hours:60P	0	0	2	0	0	0	2		
	equisite	Nil	Co-requisite					Vil				
	ramme		Bachelor of Scie									
	ester	1 T	Fall/ III semester of f									
	urse ectives	•	nt students with the various				-		ta or onna	unsa tha		
Obje	ectives	listeners.	2. To acquire the speaking skill instruct, influence, engage, educate, or appease the									
			e proficiency, present abili	tv an	d aual	ity o	f resume	e and m	rovide guida	ance for		
			otion and self-evaluation in	-	_	-		I				
		_	and train the students for t				s & wall	king into	erviews.			
	O1	Enable students to 1	ise prepositions, construct s	simple	e, com	plex,	and con	npound	sentences, a	and		
	01		active and passive voice.									
	02		basics of writing, how to av	oid a	mbigu	ity, v	vrite para	agraphs	and letters,	and		
		prepare resumes and										
	03		uct SWOT analyses, practic									
C	O 4	Equip students with their impact.	h knowledge about non-ve	rbal	comm	unica	ition, typ	oes of b	oody langua	ige, and		
C	O 5	Train students in	planning and conducting	grou	ıp dis	cussi	ons, eff	ectively	y disagreeii	ng, and		
		summarizing to atta				•			0.11			
C	O 6		r personal interviews, answ , and adhere to dress code a					uestion	s, follow te	lephone		
Unit-			ontent	ina gi	Cont	_	Lea	KL				
No.					Hou			<b>-</b>				
I	Gramm	nar (Flipped classro	oom)				Students will correctly use					
	i. Use o	f Prepositions			create							
	1	le, complex, compo		6		various structur	sentence nd conver	1 2 3				
	iii. Acti	ve and Passive Voic				between	1					
						between a passive voice						
II	Writing								write clear	1 1		
		Basics of Writing; a agraph Writing	avoid ambiguity and vaguer	ness	6		and stru- letters,					
		er Writing				letters.						
		ume and Cover Lette	er									
III	1	nagement Skills					Student					
		Γ Analysis			5		SWOT regulate		yses, self- adhere to			
		Regulation					persona	-	hygiene			
		onal Hygiene					practice					
IV			ion-Sciences of Body				Student and		understand			
	Langua	O	: .: 0 D 1 I		_			effecti t type	vely use s of body			
			munication & Body Langua	ige	5		languag		ir			
		s of Body Language					commu	nication	1.			
V	iii. Importance and Impact o  Group Discussion		n Dody Language,				Student	s will	plan and	1 3, 4		
•	_	ing and Elements of	Group Discussion				particip		in group			
		tively disagreeing,	1		5		discuss	ions,	disagree			
		marizing and Attain	ing the Objective.				constru		and cussions.	i		
VI	Intervie	ew Skills & Dress c	ode Ethics						demonstrate	2, 3		
		al Interview – Conc					effectiv	e	interview			
			tions and answering Strateg	gies	5		techniq		answe			
	iii. Tele	phone Interview Etic	quettes						ions, follow juettes, and			
	iv. Intro	duction to Dress Co	de and Grooming				dress ap			•		
	1				1		4	1 -1-1	<i>J</i> -			

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Integrate presentation, communication, leadership, and	6.7						
1	interview skills.	6,7						
2	Apply skills in real-world scenarios.	2, 6,7						
3	Reflect on personal development.	5,6						
4	Collaborate effectively in group activities.	6,7						
5	Demonstrate professionalism and ethical behavior.	5,6						

	SEMESTER – III								
<b>Course Title</b>	Te	chno-professional Ski	lls – ]	I (Biot	fertiliz	zer Pro	duct	ion)	
Course code	23BSB214R	Total credits: 1	L	T	P	S	R	O/F	C
		Total hours:30P	0	0	2	0	0	0	1
<b>Pre-requisite</b>	Nil	Co-requisite				N	Vil		
Programme		Bachelor of Sc	ience	in Bio	otechr	ology			
Semester		Fall/ III semester of	first	year o	of the j	progra	mme	;	
Course	On successful com	pletion of the course, t	he stu	idents	will b	e able	to Far	miliarize w	vith the
Objectives	basic principle and	l techniques of Biofarm	ning						
CO1	Explain the Impor	tance of biofertilizers in	n plan	ıt deve	elopme	ent.			
CO2	Describe mass cul	tivation and inoculation	1.						
CO3	Explain the impor	tance of Azolla as a bic	fertil	izers.					
CO 4	Describe the impo	rtance of phosphate in	biofe	rtilizer	S.				
CO5	Apply the knowled	dge on the use of Fungi	and ]	Мусог	rrhiza.				
Unit-No.	C	ontent	Con	tact	L	earnin	g Out	tcome	KL
			Но	our					
I	Isolation, identi	fication and analysis	30		Stude	ents w	ill be	able to	1,2,3,4
	of the potentia	lities of N2 fixing			unde	rstand	the p	rocess of	
	bacteria, Isolatio	n, identification and			biofe	rtilizer	pı	roduction	
analysis of the potentialities of using microoranisms									
phosphate stabilizing bacteria,									
	Isolation , identification and assess								
	the potentialiti	potentialities of Arbuscular							
	mycorrhizas fung	gi of rhizospheric soil							

**R1**. Kannaiyan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi. Dubey, R.C. 2001.

**R2**. P. S. Bisen. Fontiers in microbial technology. 1st edition. C.B.S. Publishers and Distributors; 1994 **OTHER LEARNING RESOURCES:** 

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9227430/

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the Importance of biofertilizers in plant	1.2						
1.	development.	1,2						
2.	Describe mass cultivation and inoculation.	1,2						
3.	Explain the importance of Azolla as a biofertilizers.	1,2						
4.	Describe the importance of phosphate in biofertilizers.	1,2						
5.	Apply the knowledge on the use of Fungi and Mycorrhiza.	1,2						

			SEMESTER -	- III							
Course 7	Γitle		Extra-Cur	ricula	r Acti	ivities					
Course o	code	23UBEC211	Total credits: 1	L	T	P S R O/F					
			Total hours: 60P	0	0	0	4	0	0	1	
Pre-requ	isite	Nil	Co-requisite				N	il			
Progran			Bachelor of Scient								
Semest			Fall/ III semester of f								
Cours			in physical and menta						and selec	et best	
Objecti	ves		for state, national and i				•				
			e and improve student's				•		oga, music	,	
			na, etc through AdtU cl								
CO1			be various sports, mus						available	at the	
804			lain the benefits of part								
CO2			techniques learned in								
			rts, music, and other		rrıcula	ar com	petitio	ons, ar	id analyze	their	
601		1	ntify areas of improvem			. 1		1		•	
CO3			ctive essay or present								
			ibuted to their personal and skill development.	and p	profess	sional g	growtr	i, and o	design a p	an Ior	
Unit-		Cont		Con	tact	Learning Outcome KL					
No.		Cont	.cnt	1	our	L	cai iiii	ig Out	Come	KL	
I	Base	ed on the learner	's interest they can		,,,,,	Stude	nts v	vill l	nave the	1	
1			sports, music, and co-						plore and		
			ning the clubs of the						erests by		
		3	Footshal; Cricket;						variety of		
		•	ll; Badminton; Table			sports			and co-		
		•	ner outdoor and indoor					ctivitie			
			Vocals; Photography;							1.0	
			ies); The students are	6	50					1,2	
			pate in regular club								
			competitions as per								
			ies; Renowned skilled								
		essionals/ person									
			to promote the talents								
		e students.	_								

R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

#### OTHER LEARNING RESOURCES:

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Identify and describe various sports, music, and co-curricular activities available at the university, and explain the benefits of participating in these activities.	1&3						
2	Apply skills and techniques learned in workshops and club activities to participate effectively in sports, music, and other co-curricular competitions, and analyze their performance to identify areas of improvement.	1,2						
3	Discuss the reflective essay or presentation assessing how involvement in various activities has contributed to their personal and professional growth, and design a plan for future engagement and skill development.	7.9,10						

			SEMESTER	– III						
Course	Title		Co-Curr	icular	Activ	ities				
Course	code	23UBEC111	Total credits: 1	L	T	P	S	R	O/F	C
			Total hours: 60P	0	0	0	4	0	0	1
Pre-requ	iisite	Nil	Co-requisite				N	il		
Progran			Bachelor of Sci							
Semest			Fall/ III semester of t							
Cours			physical and mental						and selec	t best
Objecti	ives	^	or state, national and in				•			
			and improve student					-		usic,
CO1			a, etc through AdtU to work well with othe						S	
CO2							e belle	51°.		
CO2			to manage their time as				critica	11 _v		
CO4			ove their overall health				critica	шу.		
COS			ne more aware of their				contri	bute n	ositively	
Unit-		Cont		_	ıtact			ng Out		KL
No.		Cont			our				COIIIC	
I	Co-	curricular activit	ies cover a wide			1.	Skil	l Dev	elopment:	
	rang	e of experiences	s and pursuits that			Enhar	ncing	skills	such as	
			c learning. They are			teamv	vork,	10	eadership,	
		=	nd managed within			comm	nunica	tion, ai	nd critical	
			ns or communities			thinki	_			
			l role in holistic			2.		istic	Growth:	
		elopment. Some ex				Suppo	_		emotional,	
		13. Sports and Phy	•			social	_	and	physical	
		14. Cultural Activ					opmen		alongside	1.0
			bs and Competitions	C	50	acade		arning.		1,2
		16. Community Se	•					-	Networks:	
		Volunteering	or vice and				_	• •	, mentors,	
		17. Leadership and	l Personal					ionals.	,,	
		Development	a 1 015011a1			Person			ılfillment:	
		18. Creative and H	Johny-hased			Provid		aven		
		Activities	ioooy-oaseu			creati	_		xpression,	
		Activities				and	•	oring	personal	
						intere	sts.	-		

R1: "Co-curricular Activities: A Pathway to Careers" by Ferguson.

R2: "Raman, S.R., Islam, M.A., Akash, P.P., Parvin, M., Moon, N.N. and Nur, F.N., 2021. Effects of co-curricular activities on student's academic performance by machine learning. *Current Research in Behavioral Sciences*, 2, p.100057.

#### OTHER LEARNING RESOURCES:

 $\frac{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extracurricular-activities}{}$ 

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Students will learn to work well with others and communicate better.	6,7
2	Students will learn to manage their time and stay organized.	2, 6,7
3	Students will enhance their creative abilities and think more critically.	5,6
4	Students will improve their overall health and reduce stress.	6,7
5	Students will become more aware of their role in society and contribute positively.	5,6

			SEMESTER							
Course T		<b>44</b> 00000000000000000000000000000000000		ntomolo		.   =		I		-
Course c	ode	23FSZO301R	Total credits: 2	L 2	0		S 0	R	O/F	C 2
Dro room	icito	Nil	Total hours: 30T Co-requisite	<u>Z</u>	U	U	N		0	Z
Pre-requ Program		INII	Bachelor of So	rience ir	ı Ria	ntechnol		11		
Semest		F	all/ III semester of s					mme		
Cours			the classification, i						stics of i	nsects.
Objectiv			Class Insecta.	<b>-</b>	- 6,7 ;	,	· J			,
			morphology and ada	ptations	of i	nsect mo	outhpa	rts, ant	enna, and	legs.
			e life cycles and cor	ntrol me	asur	res of m	edical	ly imp	ortant pes	ts and
			t on human health.							
		_	insect communication				iviors,	ınclud	ing their	role in
CO1			ement and forensic sorview of Class Insect				oical r	nodific	ations	
			life cycle and control							
CO2		•				*				harri
CO3		Able to explain, adopted by insects.	illustrate different c	ommun	ıcatı	ng tech	mques	and	insect be	11av10r
CO4			lustrate and implem	ent diff	eren	it manac	gemen	t strate	gy adont	ed for
204		controlling insect pe	ests.					. June	o, adopt	101
CO5		Gain knowledge on	different insects of e	conomic	e im	portance	; <b>.</b>			
Unit-		Conte		Conta				g Outc	ome	KL
No.				Hour						
I		oduction to Ento							the class	1
			classification and				nsects		nd its	
	Inse	racters. ect morphology:	Overview and	5		morphol	logical	peculi	arities.	1,2
	1		nparts, antenna and							
	legs		ipario, antonna and							
II			rtance: Life cycle		$\top$	Describe	e, i	llustrat	te and	
	and	control measures of	f Musca domestica,			explain	the		ycle and	
		es aegypti, Culex							f pest of	
		pheles, Phlebotom		7		medical	impor	tance.		1,2
		ripes, Cordylo	obiaanthropophaga, ulexirritans, Cimex							
		uttumaamnosum, Pi ularius, Triatoma i								
		ianus.	y zarowa, i conomino							
Ш	Inse		tion: Chemical		$\top$	Describe	e, i	llustrat	te and	
	1	munication, Aud							different	
	1	munication, Visua	al communication,			commur		_	echniques	
		ninescent insects	Character :::				ect beh	aviorac	dopted by	1
	Inse	ect Behavior: gmotropism,	Chemotropism, Hydrotropism,	6		insects.				1,2
		otropism,	Anemotropism,							
			motropism and							
		tropism.			_					
IV	Rol	e of insects in p				Describe	-	llustrat		
			and biological	5		explain		ne	different	1 1 7
		trol of insect's pest,							adopted	',2
V		e of insects in forens				for contr		ınsect llustrat		
V		<b>roduction to Applie</b>	et and commercial			Describe	_		te and nt insects	
			oney bee, silkworm	7		of econd				1,2
		lac insect.	, 5.00, 51110, 51111			-1 200HC				
I				<u> </u>						1

- R1: Insect pest management by Dent D R, (latest edition). Westville Publishing House: Delhi
- R2: An ecological and social approach to biological control, Eilenberg J, (latest edition). Springer.
- R3: Theory and Practice of Animal Taxonomy and Biodiversity by Kapoor V C 8Ed. Oxford and IBH publishing.

## **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the overview of Class Insects different morphological modifications.	1,2
2	Able to explain the life cycle and control measures of pest of medical importance.	1,2
3	Able to explain, illustrate different communicating techniques and insect behavior adopted by insects.	1,2
4	Able to explain, illustrate and implement different management strategy adopted for controlling insect pests.	1,2
5	Gain knowledge on different insects of economic importance.	1,2

Course code   23FSBO301R
Total hours: 30T   2   0   0   0   0   0   2
Pre-requisite   Nil   Co-requisite   Nil
Programme   Bachelor of Science in Microbiology   Semester   Fall/ III semester of second year of the programme
Semester   Fall/ III semester of second year of the programme
Course Objectives
Cotent   Content   Content   Content   Content   No.
3. The course further deals with physiology of forest, forest management and fore pathology.  CO1 Articulate the history and basic concept of Forestry.  CO2 Importance of Dendrology and knowledge of wood forest  CO3 Understanding of forest types and forest management  CO4 Importance of physiology in forestry  CO5 Understanding the forest pathology, causes of forest diseases  Unit-No.  Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  3. The course further deals with physiology of forestry.  CO2 Importance of Dendrology and knowledge of wood forest  CO3 Understanding of forest types and forest diseases  Co4 Importance of physiology in forestry  CO5 Understanding the forest pathology, causes of forest diseases  Contact Hour  Describe and explainHistory, types and policies of forest  1,  1,  1,  1,  1,  1,  1,  1,  1,  1
Dathology.
CO2 Importance of Dendrology and knowledge of wood forest  CO3 Understanding of forest types and forest management  CO4 Importance of physiology in forestry  CO5 Understanding the forest pathology, causes of forest diseases  Unit-No. Content Contact Hour  I Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Importance of Dendrology and knowledge of wood forest management  CO3 Understanding of forest types and forest diseases  Contact Hour  Describe and explainHistory, types and policies of forest types and policies of forest types and policies of forest management:  1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1
CO3 Understanding of forest types and forest management CO4 Importance of physiology in forestry CO5 Understanding the forest pathology, causes of forest diseases  Unit-No.  Content Contact Hour  Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Unit-No.  Sometiment Contact Hour  Describe and explainHistory, types and policies of forest forest  1,
CO5   Importance of physiology in forestry
Unit-No.  Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Unit-No.  Contact Hour  Describe and explainHistory, types and policies of forest types and policies of forest  1,
Unit-No.  Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Contact Hour  Describe and explainHistory, types and policies of forest  types and policies of forest  5  1,
No.  Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Hour  Describe and explainHistory, types and policies of forest  types and policies of forest  1,
I Introduction Forestry: History of forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management and their applications  Describe and explainHistory, types and policies of forest types and policies of fo
forestry, Classification of forest, Basic concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management, principle of forest management and their applications
concepts on forest types of India. Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management, principle of forest management and their applications
Important acts and policies related to Indian Forest.  Forest management: Definition and scope of forest management, principle of forest management and their applications
Indian Forest.  Forest management: Definition and scope of forest management, principle of forest management and their applications
Forest management: Definition and scope of forest management, principle of forest management and their applications
of forest management, principle of forest management and their applications
management and their applications
H Dandwalaggy Introduction immentance and Describe illustrate
II Dendrology: Introduction, importance and Describe, illustrate and
scope of dendrology. Role of vegetative explain Importance, scope and
morphology in identification of woody morphology of woody forest
forest flora Ecotourism: Definition and elements of 7 and Ecotourism 1,
ecotourism. Principles and objectives of
ecotourism. Potential of ecotourism in
India.
III Plant Physiology: Introduction to tree Describe, illustrate and
physiology, Photosynthesis. Water relation explainImportance of tree
of forest trees, transpiration from forest 6 physiology in relation to 1,
canopies, environmental effects on growth forestry.
and development.  Ny Forest Facility and Diversity Forest Describe illustrate and
IV Forest Ecology and Diversity: Forest types of India, Forest Ecosystem-abiotic Describe, illustrate and explain Importance of forest
and biotic components and their ecosystem, biotic and abiotic
interaction, Nutrient cycling, forest 5 components and forest 1,
management. Conservation measurement management and ecotourism.
of diversity, diversity hot spots, Principle
of conservation.
V Forest Pathology: Importance of forest Describe, illustrate and
pathology. Principles of forest pathology, explain Principle of for
causes of forest diseases-Physiological and not belogical general symptoms of forest diseases and plant guaranting 1,
pathological, general symptoms of forest tree disease, control of forest diseases,
plant quarantine.
piant quarantino.

- R1: Agarwal, W.P. Forests in India. Oxford and I.B.H
- R2: Arvind Kumar. Biodiversity and environment. A.P.M. Publishing Corporation, New Delhi.
- R3: Kumar and Asija. Biodiversity Principles and conservation. Updesh Purohit, Agrobios, Jodhpur

#### **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Articulate the history and basic concept of Forestry.	1,2						
2	Importance of Dendrology and knowledge of wood forest	1,2						
3	Understanding of forest types and forest management	1,2						
4	Importance of physiology in forestry	1,2						
5	Understanding the forest pathology, causes of forest diseases	1,2						

	SEMESTER – III											
Cours	e Title		Basic Life S	Saving S			)					
Cours	e code	23UULS202R	Total credits: 1	L	T	P	S	R	O/F	C		
D	• •,	NT*1	Total hours: 30P	0	0	1	0	0	0	1		
	Pre-requisite     Nil     Co-requisite     Nil       Programme     Bachelor of Science in Biotechnology											
Semo		T	Fall/ III semester of s					mmo				
Cou			rse is to provide the l						d practical	ckille		
Objec			gency fire situation, a									
		treatment for injurie	·	I		FF	F					
CO			able to recognize res	spiratory	arrest	t/ cardi	ac arre	est, and	l provide o	xygen		
		to the patients to sus										
CC			be able to perform the	ne impor	tance	of ear	ly CP	R on A	Adult, chi	ld and		
00		infants victims	11 / / / /	<u> </u>			. 1.		1.			
CC	)3		e able to prevent injur the victims from dete			worse	e, aidin	ig reco	very, relie	ving		
CC	)4		iology in environmen									
CC			e able to learn about the				equirer	nents. 1	methods o	f		
		operation and gettin		iio iiio oq	u.p.i.i		quirei	,		•		
Unit-		Conten	_	Contac	t	Le	arning	g Outc	ome	KL		
No.				Hour								
I	Basic	Life Support (BIS							ındational			
	•	Introduction of Bl	LS						ical skills			
	•	Chain of survival		_					ort (BLS),	1,2		
	•	ABCs Assessmen		5	enabling them to effectively respond to emergency							
	•	CPR and Ventilat	ion Technique		situations.							
	•	AED Chalsing for adult	and ahildran									
II	First	Choking for adult	and children		Students will acquire essentia							
11	TH St	Golden rules of F:	irst aid	5		knowledge and skills in First						
	•	First aid Kits	nst ara	3		Aid						
III	Tram	ma emergencies			St	udents	will	acauire	essential			
	•	Introduction				nowled		ınd s		1		
	•	Priorities of Initia	al approach in pre-		Tı	auma	emerg	encies				
		hospital care										
	•	Scene safety										
	•	Primary assessme	nt	5						1,2		
	•	Bleeding control								′		
	•	Extrication of transfer	victims and safe									
			tabilization and C-									
		collar application										
	•	Splinting of broke										
IV	Triag	ge system			St	udents	will	acquire	essential			
	•	Introduction			kr	owled	ge and	l skills	in Triage			
•		Flow chart approa	_	5	sy	stem				1,2		
			gle and Multiple									
* -	3	Casualties in Pre-	Hospital setting		-		•••	•				
		cal emergencies						•	e essential			
		luction n centred approach a	and Management of			nowled edical		and s gencies	skills in			
Victi		Seizures	and ividinagement of		11/1	cuical	Ciricig	,0110108				
		heart attack		3						1,2		
	•	asthma										
	•	diabetic emergence	eies									
	•	emergency childb										
i	1	<u> </u>		i						-		

	Respiratory distress and failure			
VI	<ul> <li>Environmental Emergency</li> <li>Recognizing and caring for heat related illness such as: Heat stroke,</li> <li>heat cramps, heat exhaustion, dehydration.</li> <li>Recognizing and caring for cold related illness such as frostbite,</li> <li>hypothermia.</li> <li>Poisoning, Snake bite.</li> </ul>	3	Students will acquire essential knowledge and skills in Environmental Emergency	
VII	<ul> <li>Safety of people in the event of fire</li> <li>Recognition of possible fire sources and emergency procedures,</li> <li>Construction techniques for eliminating fire.</li> <li>Types of detecting devices and extinguishing agents and systems</li> <li>Devising procedures in the event of fire and react to fire danger.</li> <li>Safety goals and objectives, Identifying hazards and risks</li> </ul>	3	Students will acquire essential knowledge and skills in Safety of people in the event of fire	

R1: Nancy Caroline'S Emergency Care in the streets eight edition by Jones and Bartlett

R2: First Aid book by LC Gupta; Publisher Jaypee Brothers, 7th Edition.

#### **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	The students will be able to recognize respiratory arrest/ cardiac arrest, and provide oxygen to the patients to sustain tissue viability	2, 3					
2	The students will be able to perform the importance of early CPR on Adult, child and infants victims	2, 3, 6					
3	The students will be able to prevent injury from getting worse, aiding recovery, relieving pain and protecting the victims from deterioration	3, 6					
4	Students will be able to respond to environmental emergency like heat stroke, snake bite etc.	2, 3, 6					
5	The students will be able to learn about the fire equipment requirements, methods of operation and getting out alive.	2, 3, 6					

		SEMESTER – III											
Course T			Personal Fir			,	_			1 -			
Course c	code	23UUFL202R	Total credits: 1 Total hours: 30P	$\frac{L}{0}$	$\frac{\mathbf{T}}{0}$	P   1	S 0	R 0	0/F 0	C 1			
Pre-requ	isite	Nil	Nil Co-requisite Nil										
Program		1111	Bachelor of Scie	nce	in Biot	echn							
Semest			all/ III semester of sec	ond	year o	f the	progra						
Cours			would offer an inclusiv										
Objectiv	ves		orrowing, lending, taxe										
			personal financial plann s ofgoal achievement.	ing j	process	, the	life cycl	e oi iii	nanciai pi	ans,			
			budget, record-keeping	g sys	stem, ar	ıd tax	k plannii	ng strat	egy base	d on			
		current fina		<i>,</i>	,		•	2	23				
CO1			agement strategy and a	plar	n to fac	ilitate	the hor	ne or a	utomobil	e			
COL		buying process	.1 :	. 41	.41 .1			1 1:66-	:				
CO2		objectives.	ed investment portfolio	) liii	at addr	esses	severa	i dille	rent mve	sunem			
CO3			en open- and closed-end	l mu	ıtual fur	ıds, e	exchange	e-trade	d funds, a	and			
		direct or indirect rea	al estate investments.										
CO4			an that covers your inc	ome	needs i	n ret	irement	and he	lps prote	ct you			
Unit-		and your estate.	ntent		Conta	ct	Lagrn	ing Ω	utcome	KL			
No.		Col	itent		Hou		Lan	ing O	utcome	IXL			
I		damentals of Finai	ncial Planning –			:	Students will acquire			Students will acquire			
		nctions of money;					essentia	l know	ledge of				
		flation- Meaning, ca trolled; iii.process of				Fundamentals of							
		ime value of money		5		Financial Planning							
		rest; v.Net Present V											
	1	-	ling; vii.Doubling peri	od									
	and	Rule of 72.											
II	Inc	come Tax Planning— i.Meaning of Income,				:	Students	will a	cquire				
	1	irect & Indirect Taxo			essential knowledge								
	1	ous heads of Income		5 and skills in Income									
		Von-taxable Income, Tax evasion and tax	ax	C	'	Tax Planning							
	1	nning Strategies	ил										
III		repreneurial plann	ing –	$\dashv$		+;	Students	s will a	cquire				
	1		eurship, prerequisites fo	or			essentia		-				
	1	oming an entreprene					and skill		J				
			port Systems in India, items for entrepreneurs,		_	]	Entrepre	eneuria	1	1.2			
		* *	stems for entrepreneurs;		5	1	planning	<b>g</b> .		1,2			
		enture Capital, Busi											
		Assistant of Government											
		Commercial Bank L											
i. Ir Ma Ma ii. S		nning for investing vestment avenues of	in securities market –				Students		-				
		kets,. Primary Mark					essentia		_				
		ket,	· <i> j</i>				and skill market	is iii se	curines				
			ng, features, functions of	f			mai KCl						
		E,BSE DEMAT trad			5					1,2			
		Security repository, serational aspects of s											
		ement of	coarmos markets.										
	orde	ers, contract note, pa	y-in and pay-out, tradir	ıg									
	and	settlement cycle,											

	iv. Various risks involved in investing in securities markets; Role of Financial Intermediaries; Stock indices. v. Mutual Funds- meaning concept, definition, types, importance and drawbacks of mutual funds, mutual funds in India, investing in mutual funds, vi. Systematic Investment Plan (SIP) and its advantages.			
V	Planning for debts and Retirement i. Consumer credit - Introduction to consumer credit; choosing a source of credit, the cost of credit alternatives, ii. Consumer Legal Protection; iii. Housing Decision: Factors and Finance; Vehicle Decisions. iv. Retirement planning - Meaning of cost of living; retirement need analysis; development of retirement plan, various retirement schemes, v. Estate Planning; Pension and Medicare Planning; Wills.	3	Students will acquire essential knowledge and skills in Planning for debts and Retirement	1,2

R1: Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by DavidJ. Mullen Jr.

R2: Personal Finance and Planning by Dr. Rajni

R3: Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh

#### **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Develop a cash management strategy and a plan to facilitate the home or automobile buying process	1,2,8
2	Design a diversified investment portfolio that addresses several different investment objectives.	1,2,8
3	Differentiate between open- and closed-end mutual funds, exchange-traded funds, and direct or indirect real estate investments.	1,2,8
4	Create a financial plan that covers your income needs in retirement and helps protect you and your estate.	1,2,8

	SEMESTER – IV									
Cours	e Title		Food I	Biotechnol	ogy					
Cours	e code	23BSBT221R	<b>Total credits:4</b>	L	T		R	O/F		C
			Total hours: 45T+30	P 3	0 2		0	0		4
	quisite	Nil	Co-requisite			Ni	il			
	amme		Bachelor of Sci							
	ester		Fall/ IV semester of							
	ırse		ctive of this course is			iotechn	ologica	ıl appl	icat	ions
Obje	ctives		n other courses and rela			11	<b>C</b> .			
			give students a com	-		_		-		
			ological food additi	ves, biote	echnologi	ical Io	ood a	iagnos	51S	and
		regulation	oundational principles	of hiotechr	nology ar	nd its a	nnlicat	ion in	the	food
CO	01	industry.	dilidational principles	or blottern	lology al	iu its a	ррпсат	1011 111	tiic	1000
			ce behind GMOs, their	developm	ent their	r role ir	food 1	roduc	tion	and
CC	)2	ethical issues.		ac / cropm	,	. 1010 11	. 100 <b>u</b> j	- Louis		. 4114
CO	)3		les and applications of	fermentati	on in foo	d produ	action.			
		* *	echnological approach					xtendi	ng	shelf
	) 4	life.			-	•			-	
CO	) 5	1 1 1	edge on industry trends			ncludin	g the d	levelop	me	nt of
	, <u> </u>		nutraceuticals, and bio							
Unit-		Conte	ent	Contact	Lea	rning (	Outcon	ne	K	L
No.	T . 1			Hour	<b>D</b> 1:	.4 .				
I			nnology in the Food	8	Explain					
		•	piotechnology and its roduction, historical		biotech:		in	the	1	2
	develo	•	ey milestones in		100d inc	uustry			1,	,2
		nnology in food	cy minestones in							
II			Organisms (GMOs)	10	Underst	tand th	e role	of		
		*	eience behind GMOs:		GMOs	in		ood		
	genetic		techniques and		product			rop		
	applica	ations, Role of C	GMOs in improving		improve	ement	and the	heir	1,	,2
	crop y	ield, quality, and s	sustainability, Ethical		ethical	conside	rations	s.		
			oversies surrounding							
	GMOs									
III			Food Production:	8	Describ		mentat			
	_ ^		n and its significance		process		for	the		
			s of fermented foods cultures, Industrial		product beverag		10008	anu	1,	,2
		~	ogical advancements		ocverag	303				
		nentation.	Sicui advancements							
IV			roaches to Food	10	Explain	the	role	of		
Safety				biotech			for			
		hnological metho		extendi		od sat	fety	1	2	
	assurar	nce, Techniques fo	or extending shelf life		and pre	_			1,	,2
		-	studies and examples							
		essful applications								
V		ry Trends an		10	Explain		role	of	_	
			merging trends in		biotech				1.	,2
	functio		and nutraceuticals,		product	non of	tunctio	onal	-,	
	Biotor	tification techniqu	ies to enhance food		foods.					

	nutritional value, Regulatory aspects and consumer acceptance of functional foods		
Pract ical	<ol> <li>Quality analysis of milk by MBRT</li> <li>Isolation of food borne bacteria and fungi from food products.</li> <li>Microbiological examination of canned foods.</li> <li>Isolation of spoilage bacteria from fruits and vegetables.</li> <li>Adulterant test: formalin and starch test</li> <li>Effect of temperature on the spoilage of food products.</li> <li>Production of fermented food: Yoghurt, Kim chi</li> </ol>	Able to use various methods for the quality analysis food and fermented food production.	1,2,3,4

**R1**. Introduction to Food Biotechnology. Author; Perry Johnson-Green. Publisher; CRC Press. Year; 2002.

R2. Brown. T. A. Gene Cloning and DNA Analysis: an introduction. 7th edition. JOHN WILEY; 2016.

#### **OTHER LEARNING RESOURCES:**

https://www.annualreviews.org/doi/abs/10.1146/annurev-arplant-042809-112116

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the foundational principles of biotechnology and its application in the food industry	1,2
2	Explore the science behind GMOs, their development, their role in food production and ethical issues.	1,2
3	Learn the principles and applications of fermentation in food production.	1,2
4	Know about biotechnological approaches to ensuring food safety and extending shelf life.	1,2
5	Apply the knowledge on industry trends and innovations, including the development of functional foods, nutraceuticals, and bio fortification.	1,2, 3

			SEMESTER	– IV						
Course	Title		Develop	menta	al Bio	ology				
Course	code	23BSBT222R	Total credits:3	L	T	P	S	R	O/F	C
			Total hours: 45T	3	0	0	0	0	0	3
Pre-requ	uisite	Nil	Co-requisite				N	Vil		
Prograi	nme		Bachelor of Sci	ence i	n Bio	otechno	ology			
Semes	ter		Fall/ IV semester of t	first y	ear o	f the p	rogra	mme		
Cour	se		uce animal and plant'	s emb	ryon	ic deve	lopme	ent th	at is hov	an egg
Object	ives		nto an adult.							
		2. To prepare	e for advanced courses	such a	ıs An	imal an	ıd Plaı	nt Bio	technolog	_y
CO		Learn the concept	of gametogenesis, ferti	lizatio	n in j	plants a	nd an	imals.		
CO2	,	Describe the proce	ess of pollination and fe	ertiliza	tion i	in plant	S			
CO3		Describe and illust	trate post-fertilization p	rocess	s in p	lants ar	nd anii	mals		
CO 4	4	Explicate the proc	ess of gamete formation	n in m	ale a	nd fema	ale ani	imal		
CO:	5	Discuss the fertiliz	zation and embryonic st	tages o	of ma	mmals.				
Unit-		Cont	tent	Con	tact	Le	earnir	ıg Ou	tcome	KL
No.				Но	ur					
I		togenesis-I (Ma	le): History and			Under		describ	be,	1,2
	Scope embry				and explain gametogenesis					
		ire of stamen,	Angiosperm Flower, Microsporogensis,	7						
	Dehisc	ence;	Gametogenesis- carpel, Types of							
		nale),Structure of								
			Structure of typical , Allium and Adoxa							
	type)	o sae, (relygonam	, minim una manu							
II	Pollina		on: Pollination, Pollen		Understand, describe,			be,	1,2	
		ntry (Types), Syngan	1	0	illustrat		aollina	tion and		
	Double	e lettilization, Devel	opment of Endosperm			and explain pollination and fertilization			non and	
III		ertilization: Types o				Understand, describe,				1,2
		sors and synergids,		1	0	illustrat		• o at for	utiliaatian	
	matura	nbryony, Fruit- deve	iopmeni and			and ex	.piaiii j	Jost 1ei	tilization	
IV			ls-I, Ultra structure of			Under	stand,	descril	oe,	1,2
		in mammals. Speri	matogenesis-Formation			illustrat			1	
	of	atids and sparminger	nesis, Ultra structure of	8	₹	gameto anima		s in		
Sperm structu			in amimals-II, Ultra		,	aiiiiia	15			
			mmals, Oogenesis in							
	mamm		structure, Yolk-its							
V	Fortil	on and significances zation in Mammals	• Sperm egg	-		Under	ctand	desoril	20	1,2
V	encour	ter, Capacitation and	d Sperm transport,			illustrat				1,2
Acros		mal		1	0	fertiliza	ition in			
	reactio	-	tion and Amphimixis.	•	_	mamn	nals			
			and Types of Clevage. on Salient features and							
	Signifi		on sunom reatures and							

- R1. Allan. Essentials of Human Embryology. 2ndedition. Oxford University Press, New York,1969.
  R2. Rana. Human Embryology made Easy. 1st edition. CRC Press; 2019.
  R3. Lersten. Flowering Plant Embryology. 1st edition. Wiley-Blackwell; 2004.

## **OTHER LEARNING RESOURCES:**

 $\underline{https://pubmed.ncbi.nlm.nih.gov/28590698/}$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Learn the concept of gametogenesis, fertilization in plants and animals.	1,2						
2	Describe the process of pollination and fertilization in plants	1,2						
3	Describe and illustrate post-fertilization process in plants and animals	1,2						
4	Explicate the process of gamete formation in male and female animal	1,2						
5	Discuss the fertilization and embryonic stages of mammals.	1,2						

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3							
Science in Biotechnology of first year of the programme							
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KL							
1,2							
1,2							
1,2							
1,2,							
3							
1,2,							
3							
٦							
1,2, 3,4							
3,4							
3							

- R1. Sharma T. R. Genome Analysis and Bioinformatics: A Practical Approach (English) (Paperback). 1st edition. Dreamtech Press; 2019.
- R2. Orengo C.A. et al. Bioinformatics: Genes, proteins and computers. 1st edition. Taylor & Francis, 2002.
  R3. Kangueane P., Mathura V. Bioinformatics: A Concept-Based Introduction. 1st edition. Springer-Verlag New York Inc. 2009.

## **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/28590698/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Learn basics of computer and its applications in Biology, including data analysis.	1,2,3							
2	Impart knowledge on various molecular sequence and structure databases.	1,2,3							
3	Develop skills in using bioinformatics tools for sequence alignment and analysis.	1,2,3							
4	Demonstrate data retrieval and alignment of the sequences and various formats	1,2,3							
5	Describe the existing biological database and their utilization	1,2,3							

			SEMESTER	– IV							
Cour	se Title		Biophy	sical c	hem	nistry					
Cour	se code	23BSBT223R	Total credits:3	L	T	P	S	R	O/F	(	C
			Total hours: 45T	3	0	0	0	0	0		3
Pre-r	equisite	Nil	Co-requisite				ľ	Nil			
Prog	ramme		Bachelor of Sc	ience i	n Bi	iotechn	ology				
Ser	nester		Fall/ IV semester of								
	ourse ectives		the students about cond the energy relations		buf	ffer, pH,	acid	and ba	se, chemic	al	
_ Ծնյ	ectives		m understand how the		ein :	folds ar	nd wh	at phe	enomenon	lea	d to
(	CO1		s of pH, buffers and rel	ated th	eori	ies					
	CO2		mechanics and the laws				t.				
	CO3	<b>A A</b>	rent bonding and force					lecule.			
	CO 4	Know the laws of									
C	O 5		anism of protein folding	<u>g</u>							
Unit		Conte	*	Conta	act	L	earni	ng Ou	itcome		K
-No.				Hou	r			0			L
I			n; Bronsted & Lowry		Ι	Describe	, illus	trate a	nd explain	l	
	Capacity	; H-H equation;	fering action; Buffer Biological Buffers;	10	$0 \mid b$	oH, buff	ers an	d relat	ed theories	S	1,2
		s of water	(61			· ·	*11		1 1 .		
II			omic structure (Shape ody radiation; Plank's	10					nd explain and the lav		1 2
	law; Pho		lybridization structure	1'		ssociate					1,2
III	of atom.	l banding: Ionic	Covalent, Hydrogen		Т	Describe	and e	vnlain	the		
1111	bond; Pe	ptidyl bond; Vande	er Waal forces	1.					d Forces		1,2
				for interaction of a molecule						1,2	
IV	Thermo	dynamics: First la			Describe he laws			nd explain	1		
	entropy);	free energy in b	ee energy, enthalpy, iological system, 3rd	10		ne iaws	or the	imouy	mannes		1,2
	law; Sign	ificance and limita	ntion of the laws.	1		,	*11		1 1 .		-,-
V		s of protein foldin lic, &hydrophobic	g:(Amino acids,		. 1	Jescribe he meck	, illus ianisn	trate a	nd explain otein foldi	l nσ	1.2
		s);Biophysics of ce	ell membranes.	8	5	110 111001	14111511	1 01 pr	own foldi	••5	1,2

- **R1**. Cantor and Schimmel. Biophysical Chemistry. 1st Ed., W.H. Freeman 6 Co., San Francisco; 1980. **R2**. Holde, Johnson and Ho. Principles of Physical Biochemistry. 2ndEd.. Pearson Prentice Hall; 2005.
- R3. S. E. Harding and Chowdhry. Protein-Ligand Interactions: Hydrodynamics and Calorimetry: A Practical Approach. 1st Ed. OUP Oxford; 2000.

## **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/33254009/

	CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome								
1	Learn the concepts of pH, buffers and related theories.	1,2,3								
2	Explain quantum mechanics and the laws associated with it.	1,2,3								
3	Illustrate the different bonding and forces for interaction of a molecule.	1,2,3								
4	Know the laws of thermodynamics.	1,2,3								
5	Explain the mechanism of protein folding	1,2,3								

				SEMESTE	ER – I	V								
Course '	Title			Basic	es of F	000	d Scie	nce						
Course	code	23BSF	FD401R	Total credits:3	L	,	T	P	S		R	О	/ <b>F</b>	C
				Total hours: 45T	3		0	0	0		0	(	0	3
Pre-requ	uisite	ľ	Nil	Co-requisite						Nil				
Program	nme			Bachelor of										
Semes				IV semester of					_					
Cour			_	foundational unders		_				_			od.	
Object	ives			fundamental princip			_		-		_			
		1	-	ne chemical reactions				_	_			ng and	d stora	age.
COI				ional understanding							ood.			
CO2				ental principles of fo							1 .			
CO3		_		cal reactions that occ		rınş	g food	ı pro	cessii	ng ai	nd st	orage	<b>e</b> .	
CO ₂	+			s of food microbiolo	<u> </u>			14		41	4 4 -			4
COS	5	1	_	sensory evaluation t food products.	ecnnic	ques	s usec	i to a	ssess	tne	taste	e, aroi	ma, te	xture,
Unit-		апи арре		ntent		C	ontac	4	Lag		~ O		<b></b>	KL
No.			Co.	ntent			ontac Hour		Lea	rmm	ig O	utcor	ne	KL
I I	Intro	duction	to Food	Science: Overview	of		6		earn	bas	ics	of	food	
1	food	science		s importance, ba			O		ience		105	OI	1000	1,2
			nents of food: carbohydrates, proteins,						TOTICE	,				1,2
	_		s, mineral	•	,									
II				niques: principles a	and		6	U	nders	tand	l ba	asic	food	
			_	eservation (e.g., h				pı	ocess	sing	tech	nique	es	1,2
	proces	ssing, dr	ying, fre	ezing), techniques	for									
	food p	packaging	g and stor	age										
III	Chem	nical Rea	ctions in	Food Processing an	ıd		8	E:	xplair	1		chei	mical	
		_		ges during cooking,				cł	nange	S	duri	ng	food	1,2
	1	_		d aging, factors				pı	ocess	sing	and	stora	ge	
		-	emical rea	ections: pH, temperat	ture,									
	enzyn													
IV			~	troduction to food b			8		nders				obial	
	r '	_		e organisms, micro					nange			d	uring	1,2
				ctors affecting micro	obial			te	rmen	tatıo	n			
<b>X</b> 7		h in food		E4ii-1£			0	T.	1.:.	. 41.		••	1 C	
V		-		Food: principles of			8		_		_	_	le of	1 2
		-		e, aroma, texture, d techniques for					ensory ood			ation		1,2
				a techniques for							or	qı	ıality	
	senso	ry evalua	шоп					as	sessn	nent.	<u>.                                    </u>			

- R1. Miriah Pace and Rick Parker. Introduction to Food Science and Food Systems. 2ndEd., Delmar Cengage Learning; 2016. **R2**. Srilakshmi. Food Science. 7th Ed., New Age International Publishers; 2018. **R3**. Potter. Food Science; 5th Ed., CBS Publishers & Distributors Pvt Ltd, India; 2007.

### OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/33254009/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Acquire a foundational understanding of the basic components of food.	1, 2
2	Learn the fundamental principles of food processing techniques.	1, 2
3	Explore the chemical reactions that occur during food processing and storage.	1, 2
4	Examine the basics of food microbiology.	1, 2
5	Gain insights into sensory evaluation techniques used to assess the taste, aroma, texture, and appearance of food products.	1, 2, 3

			SEMESTER	- IV							
Course	Title		Fore	nsic I	Biolog	gy					
Course	code	23BSFS401R	Total credits:3	L	T	P	S	R	O/F	C	
			Total hours: 45T	3	0	0	0	0	0	3	
Pre-requ		Nil	Co-requisite		· D:			Vil			
Prograi		Bachelor of Science in Biotechnology									
Semes Cour		IV semester of first year of the programme									
Object			1. Understand the significance and relevance of biological evidence in criminal investigations								
Object	1103	<ul><li>investigations.</li><li>Understand the importance of DNA profiling in forensic identification and its</li></ul>									
		limitations	•	1		0					
		3. Learn met	hods for the detection a	ınd aı	nalysi	s of blo	odstai	ns, in	cluding		
		presumpti	ve and confirmatory tes	sts.							
CO		*	ional understanding of								
CO2	2		es and techniques of Di		•						
CO3	3	l .	sis of bodily fluids, wit	h a fo	ocus (	on bloo	dstain	patter	n analysis	s and the	
CO	1	l .	lood group antigens. e of entomology and an	thron	olog	in fore	encic i	nvecti	gations		
			otocols and procedures								
CO	5	l .	cal evidence from crime			1 001100	, in 6, 1	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	mg, and		
Unit-		Cont			ntact	L	earnii	ıg Ou	tcome	KL	
No.				Н	our						
I			sic Biology: Overview	6	5	Under			sics o	f	
			ope, applications, and			forens	ic biol	ogy		1,2	
		ical development,	1:								
	_	sic biology	cal considerations in								
II	Princ		chniques of DNA	6	5	Explai	n the	e pri	nciple of	f	
	Analy	-	cture and function			_		•	ng PCR	1,2	
	releva	ant to forensic app	olications, Techniques			_	•			1,2	
	in	DNA extracti	on, quantification,								
	_	fication (PCR), and	<u>`</u>								
III			ids: Identification and	8	3	_			nanism o	1 0	
			odily fluids (blood,						erpretation	1 1,2	
		ples, methods, and	tain pattern analysis:			of bod	ny nu	ius			
IV	_		and Serology: Blood	8	3	Descib	e t	echnic	ues for	r	
			forensic significance,			blood			-	1,2	
	techni	iques for blood gro	oup antigen testing and								
	serolo	gical analysis									
V		of Anthropology i		8	3	Discus			forensio		
		tigations: Forensic				anthro	polog	У		1,2	
		fication of human									
		gical profiling, met sis and age estimat									
	_	~	evidence collection								
		reservation	cridence contention								
L	т. Р										

R1. Schober, Li, Norman; Forensic Biology; 2nd Ed.; Taylor & Francis Ltd; 2021.
R2. Mia; Sharma; Singal. Handbook of Forensic Biology & Forensic Serology; 1st Ed.; Selective & Scientific Books, 2022.

## OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/33809459/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Acquire a foundational understanding of forensic biology.	1, 2
2	Learn the principles and techniques of DNA analysis.	1, 2, 3
3	Explore the analysis of bodily fluids, with a focus on bloodstain pattern analysis and the identification of blood group antigens.	1, 2, 3
4	Investigate the role of entomology and anthropology in forensic investigations.	1, 2
5	Understand the protocols and procedures involved in collecting, preserving, and analysing biological evidence from crime scenes.	1, 2, 3

SEMESTER – IV										
Course T	itle	Te	chno Professional Ski	ll – I)	(Mu	shroon	n Cul	tivatio	n)	
Course co	ode	23BSBT224R	Total credits:2	L	T	P	S	R	O/F	C
		23D3D1224K	Total hours: 30P	0	0	2	0	0	0	2
Pre-requi	isite	Nil	Co-requisite				N	Vil		
Program	me		Bachelor of Sci	ence	in Bio	techno	ology			
Semeste	er		IV semester of fire	st yea	r of t	he pro	gram	me		
Course	e	1. To create	awareness about the M	ushro	om an	nong th	e peo	ple.		
Objectiv	ves	2. To strengt	hen the promotion of m	nushro	om c	ultivati	on by	establi	ishing a w	ell-
		equipped 1	laboratory and offices.							
		3. To know a	and explore the cultivat	ion in	Assa	m				
CO1		Explain different o	classes of mushroom.							
CO2	þ	Understand reprod	luction and growth of n	nushro	oom.					
CO3		Explain mushroon	n spawn production.							
CO 4		Discuss the methods of cultivation of mushroom.								
CO 5		Explain the techni	ques for the utilization	of mu	shroo	m spen	ıt			
Unit-		Con	tent	Con	tact	Le	earnii	ng Out	come	KL
No.				Н	our					
	_		mushroom cultivation;	6					rate the	
r		aration and production of mother culture, techniques required to harmonier and commercial spawn; preparation and mushroom cultivation						1,2		
			spawn; preparation and			mushro	om cu	Itivatio	n	
		tion of mushroo	•							
L I	manage	ement by vermicom	posting.							

R1. Gogoi et al. Mushroom Cultivation Technology. 1st edition. Scientific Publishers Journals Dept. 2006.

**R2.** Fleming. The Mushroom Cultivation Guide: A Beginner's Bible with Step-by-Step Instructions to Grow Any Magical Mushroom at Home (DIY Mushroom). 1st edition. 2019.

#### **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/30027491/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain different classes of mushroom.	1,2,3							
2	Understand reproduction and growth of mushroom.	1,2,3							
3	Explain mushroom spawn production.	1,2,3							
4	Discuss the methods of cultivation of mushroom.	1,2,3							
5	Explain the techniques for the utilization of mushroom spent	1,2,3							

			SEMEST	ER – IV									
Cour	se Title		Englis	h for Emp	oloyab	ility							
Cour	se code	23UBPD222R	<b>Total credits: 2</b>	L	T	P	S	R	O/F	(	7		
			Total hours: 32	0	0	2	0	0	0	2	2		
Pre-re	equisite	Nil	Co-requisite				Ni	il					
Prog	ramme		Bachelor of	Science in	ı Biote	chnol	ogy						
Semester Spring/ IV semester of second year of the programme													
Co	urse	1. To develop	public speaking	skills, inc	luding	script	t prep	aration	, underst	andi	ng		
Obje	ectives	nonverbal c	ues, overcoming fe	ear, and pr	acticin	g spea	king s	trategi	es.				
		2. To provide	practical experience	ce in prep	aring,	submit	tting,	and sci	reening re	sum	nes		
		and cover le	etters.										
		3. To teach en	nail etiquette, inclu	uding the	structu	re of	emails	and et	ffective d	rafti	ng		
		techniques.											
			students for inte		hrough	pract	tice v	vith co	ommonly	ask	ed		
		_	nd mock interview										
			e conflict manager					• •					
C	CO1	Enable students to p		lerstand no	nverba	al cues	, over	come f	ear, and p	racti	ice		
		public speaking stra											
	O2	Equip students with											
	O3	Teach students the d	•					_	•				
C	<b>O</b> 4	Prepare students for		cticing cor	nmonl	y aske	d ques	tions a	and partic	pati	ng		
		in mock interview s											
C	<b>O</b> 5	Students will unders	stand the concept of	of conflict	manag	ement,	, ident	ify diff	ferent typ	es, a	nd		
	_	analyze its effects.											
Unit		Unit Content Contact				8							
-No.				Hour	- 1						L		
-No.		Speaking Skills							to create	;	L		
	i. Prepa	ration of Scripts and	_		effec	etive	spea	aking	scripts	;			
	i. Prepa Nonver	ration of Scripts and bal cues of Public Sp	peaking		effec	ctive pret no	spea onvert	aking oal cue	scripts s, manage	;	3,		
	i. Prepa Nonver ii. Undo	ration of Scripts and bal cues of Public Sperstanding and Overd	peaking	Hour	effectinter public	ctive pret no ic sp	spea onvert eaking	aking oal cues g anxi	scripts s, manage iety, and	; ; ; 3			
	i. Prepa Nonver ii. Undo Public	uration of Scripts and bal cues of Public Sperstanding and Overd Speaking	peaking coming Fear of	Hour	effectinter publi	etive pret no ic spetice	spea onverb eaking effec	aking oal cues g anxi	scripts s, manage	; ; ; 3	3,		
I	i. Prepa Nonver ii. Undo Public ii. Prac	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Pub	peaking coming Fear of olic Speaking	Hour	effectinter public practitechi	etive pret no ic sp tice niques	spea onverb eaking effec	aking oal cues g anxi tive	scripts s, manage iety, and speaking	3 1 4	3,		
	i. Prepa Nonver ii. Undo Public ii. Pract	uration of Scripts and bal cues of Public Sperstanding and Overd Speaking	peaking coming Fear of olic Speaking	Hour	effectinter public practitechi	etive pret no ic sp tice niques ents	spea onverb eaking effec will p	aking oal cues g anxi tive orepare	scripts s, manage iety, and speaking s, submit	; ; ; ;	3,		
I	i. Prepa Nonver ii. Undo Public ii. Prac Practic letter	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Residual Speaking	peaking coming Fear of olic Speaking ume and Cover	Hour	effectinter public pract techic stud and	etive pret notice tice niques ents version	spea onverb eaking effec will p	aking oal cues g anxi tive orepare	scripts s, manage iety, and speaking	; ; ; ;	3,		
I	i. Prepa Nonver ii. Undo Public ii. Prac Practic letter i. Prep	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultantion, submission	peaking coming Fear of olic Speaking ume and Cover	Hour	effectinter public practitechi	etive pret notice tice niques ents version	spea onverb eaking effec will p	aking oal cues g anxi tive orepare	scripts s, manage iety, and speaking s, submit	; ; ; ;	3,		
I	i. Prepa Nonver ii. Undo Public ii. Practic Practic letter i. Prep Resumo	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultantion, submission e.	peaking coming Fear of olic Speaking ume and Cover & screening of	Hour 7	effectinter public pract techic stud and	etive pret notice tice niques ents version	spea onverb eaking effec will p	aking oal cues g anxi tive orepare	scripts s, manage iety, and speaking s, submit	; ; ; ;	3,		
I	i. Prepa Nonver ii. Undo Public ii. Prac Praction letter i. Prep Resumo ii. Prac	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultation, submission education, submission education on covere tical session on co	peaking coming Fear of olic Speaking ume and Cover & screening of	Hour 7	effectinter public pract techic stud and	etive pret notice tice niques ents version	spea onverb eaking effec will p	aking oal cues g anxi tive orepare	scripts s, manage iety, and speaking s, submit	; ; ; ;	3,		
I	i. Prepa Nonver ii. Undo Public ii. Prac Practic letter i. Prep Resumo ii. Prac session	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultation, submission e.	peaking coming Fear of olic Speaking ume and Cover & screening of	Hour 7	effectinter public pract technology Studend letter	pret no ic spotice niques ents v evaluars.	spea onverteaking effec will pute res	aking pal cues g anxi tive prepare umes a	scripts s, manage iety, and speaking , submit and cover	3 3 4 4	3, 4		
I	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resume ii. Prac session Email I	ration of Scripts and bal cues of Public Sperstanding and Overon Speaking tice strategies of Public al session on Resultation, submission et cal session on covertical session o	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening	7 5	effectinter public pract technic Studiand letter	pret no ic spritice niques ents versuluars.	spea onverteaking effectory will patterness	aking pal cues anxiotive prepare umes a	scripts s, manage iety, and speaking , submit and cover	33 33 33 33 33 33 33 33 33 33 33 33 33	3, 4		
I	i. Prepa Nonver ii. Undo Public ii. Prac Practic letter i. Prep Resumo ii. Prac session Email I i. Diff	ration of Scripts and bal cues of Public Sperstanding and Overon Speaking tice strategies of Public al session on Resultation, submission et ical session on coverence tical session on	peaking coming Fear of olic Speaking ume and Cover  & screening of the letter screening of and Usage	Hour 7	effectinter public pract technology Stude and letter Stude structure structu	ents veents	spea converte eaking effect. will pate res	aking pal cues anxitive prepare umes a unders anails a	scripts s, manage iety, and speaking , submit and cover	33 33 33 33 33 33 33 33 33 33 33 33 33	3, 4		
III	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resume ii. Prac session Email I i. Diff ii. Dra	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultation, submission e. Etiquettes ferent Parts of Email fiting emails effective	peaking coming Fear of olic Speaking ume and Cover  & screening of or letter screening  and Usage ely	7 5	effectinter public pract techn Stud and letter Stud structure them	ents vertice ents	spea onverte eaking effec will pute res will of entively.	nking pal cues anxiotive prepare umes a unders anails a	scripts s, manage iety, and speaking , submit and cover stand the	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3, 44		
I	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resume ii. Prac session Email I i. Diff ii. Dra Intervie	ration of Scripts and bal cues of Public Sperstanding and Overd Speaking tice strategies of Public al session on Resultation, submission et ical session on covere Etiquettes ferent Parts of Email fiting emails effective w Skills (Mock session on covere we skills (Mock session on covere cove	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions)	7 5	effectinter public pract technology Student and letter Student	ents venture a effection of the control of the cont	spea converte eaking effect. will pate res will of entively.	unders	scripts s, manage iety, and speaking , submit and cover stand the and draf	3 2 2 2 2 3 1 3 3 1 3 3	3, 4		
III	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resumo ii. Prac session Email I i. Diff ii. Dra Intervie i.Prepa	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultation, submission et ical session on covere Etiquettes ferent Parts of Email fing emails effective w Skills (Mock sessing Commonly askering Commonly askering serious of Public P	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions)	7 5	effectinter public pract technology Student St	ents ture ents view	spea onverteaking effec will pute res will of entively will a	unders answer ons co	scripts s, manage iety, and speaking , submit and cover stand the and draf  common	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3, 44		
III	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resumo ii. Prac session Email I i. Difi ii. Dra Intervici i.Prepa Questio	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Researation, submission et.  Etiquettes ferent Parts of Email fting emails effective w Skills (Mock session Commonly askerons	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions)	7 5 5	effectinter public pract technology Stud and letter Stud structure them.	ents view performance of the per	will of entively.	unders answer ons co	scripts s, manage iety, and speaking , submit and cover stand the and draf	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3, 4		
III IIV	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resuma ii. Prac session Email I ii. Dra Intervie i.Prepa Questic ii.Mock	ration of Scripts and bal cues of Public Sperstanding and Overd Speaking tice strategies of Public al session on Resultant aration, submission et ical session on covere Etiquettes ferent Parts of Email fing emails effective w Skills (Mock sessions a Interview sessions	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions)	7 5 5	effectinter public pract technology Student and letter Student	ents view perforviews.	spea converte eaking effect will pate res will a fuctively.	unders answer ons cowell	scripts s, manage iety, and speaking , submit and cover  stand the and draf  common onfidently in mock	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3, 4 3 3, 5		
III	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resume ii. Prac session Email I i. Diff ii. Dra Intervie i.Prepa Questic ii.Mock	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultant aration, submission etc.  Etiquettes ferent Parts of Email fiting emails effective w Skills (Mock sessions Commonly askerons at Interview sessions et Management	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions)	7 5 7	stud structhem Stud inter and inter Stud	ents view perforviews.	will a questiorm	unders answer ons cowell	scripts s, manage iety, and speaking r, submit and cover stand the and draf  commor onfidently in mock	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3, 44 3 3 3, 5		
III IIV	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prepa Resuma ii. Prac session Email I ii. Dra Intervie i. Prepa Questic ii. Mock	ration of Scripts and bal cues of Public Sperstanding and Overon Speaking tice strategies of Public al session on Resultant and session on Resultant session on covered the session on	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions) ed Interview	7 5 5	effectinter public pract technology Stud and letter Stud structure stud inter and inter Stud concerns.	ents ents ents ents ents ents ents ents	spea converte eaking effectively.  will a question or m  will a conflictively.	unders answer ons cowell	scripts s, manage iety, and speaking , submit and cover  stand the commor confidently in mock stand the magement	3 3 4 3 3 4 3 4 3 4 4 5 4 5 4 5 6 5 6 6 6 6 6 6 6 6 6 6 6	3, 4 3 2, 3, 5		
III IIV	i. Prepa Nonver ii. Undo Public ii. Practic letter i. Prep Resuma ii. Prac session Email I ii. Dra Intervie i. Prepa Questic ii. Mock Conflic ii. Defin ii. Type	ration of Scripts and bal cues of Public Sperstanding and Overo Speaking tice strategies of Public al session on Resultant aration, submission etc.  Etiquettes ferent Parts of Email fiting emails effective w Skills (Mock sessions Commonly askerons at Interview sessions et Management	peaking coming Fear of  blic Speaking  ume and Cover  & screening of  er letter screening  and Usage ely sions) ed Interview	7 5 7	stud structhem Stud inter and inter Stud concident	ents ents ents ents ents ents ents ents	will a questiorm	unders answer ons cowell unders ict maint typ	scripts s, manage iety, and speaking , submit and cover  stand the commor confidently in mock stand the magement	3 3 4 3 3 4 3 4 3 4 4 5 4 5 4 5 6 5 6 6 6 6 6 6 6 6 6 6 6	3, 44 3 3 3, 5		

- 1. Barrett, Grant.2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2.Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4.McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **Reference Books:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- 4. Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### **Other Learning Resources:**

https://learning.shine.com/talenteconomy/career-help/top-group-discussionskills

https://www.coursera.org/articles/conflict-management

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and practice public speaking strategies.	1,2,3							
2	Equip students with skills to prepare, submit, and screen resumes and cover letters.	1,2,3							
3	Teach students the different parts of an email and effective email drafting techniques.	1,2,3							
4	Prepare students for interviews by practicing commonly asked questions and participating in mock interview sessions.	1,2,3							
5	Students will understand the concept of conflict management, identify different types, and analyze its effects.	1,2,3							

			SEMESTER								
Course 7			Plant I	Biote	chno						
Course	code	23BSBT311R	Total credits:4		L	T	P	S	R	O/F	C
			Total hours: 45T+301	P	3	0	2	0	0	0	4
Pre-requ		Nil	Co-requisite					N	il		
Progran			Bachelor of Sci								
Semest			V semester of firs	_			rogr	amme	!		
Cours			ue culture techniques and	•	•						
Objecti	ves	I	students understand abou			-	_				
		_	on, DNA transfer and Bid till on media preparation,				rop I	mprov	ement		
CO1			techniques and concep				e cult	ure.			
			methods for transform						cells	includi	ing their
CO2				matro	11 01	Piani	ts or	Piani	cens,	moradi	ing then
specific advantages and applications,  CO3 Elaborate on somatic hybridization and associated techniques											
CO 4			thods of genetic engine				•				
			s of biotechnological a					rover	nent tl	rough	genetic
CO 5	)	engineering technology		avalic	.cs 10	n C10	ի ուղ	710VCI	nent ti	nougn	genene
Unit-No.		engineering technologie Cont		Con	ıtact		Lagr	nin-	Ontoo	me	KL
Unit-No.		Con	tent		nacı Dur		Lear	ning (	Outco	me	KL
I	Basic	techniques and t	cools in Plant Tissue	по	Jur	Г	Descri	he Tico	sue cult	hire	
1	Cultur		oois iii Tiant Tissuc				echni		suc cur	iuic	
	Totipo	otency. Establishmer	nt of plant tissue culture					•			1,2
	lab:	equipment, cultu		1	0						
			plants, pre-treatment of								
	_		repeated transfer of								
		culture media and	Composition of various their preparation.								
	1		s, suspension cultures								
II	Somat		Introduction to the			Γ	Descri	be			
	proces			9			embryogenesis,				1.2
		mbryogenesis and organogenesis and their cal applications: Somaclonal variations				organogenesis and somaclonal variation					
	andits				3	Omac	ionai v	ariatioi	П		
		cance.									
III	Introd	uction of so	matic hybridization,					n soma			
		uction to						ization			1,2
			inciples of protoplast, Testing of viability of		0			iast isc ization	lation,		
	1		arious steps in the				yoria	Zution			
	1	eration of protoplasts	-								
		dization & Cyb	rids- definition and								
IV	applic		NA transfer-Direct			E	Typlo:	n DN A	transf	er	
l V		ansfer-	MAINSTEL-DIRECT				netho		u anisi	C1	
	Particl	le bombaro	_	.	8						1,2
		•	nification, Liposome	'	o						
		_	Mechanisms of DNA								
	1	nsfer-Indirect Gene transfer-, Features of Ti I Ri plasmids, Role									
	1	n plasmids, Role ilence genes Use of	Ti and Ri as vectors								
V	Biotec	chnology for	Crop Improvement,						pplicat		
	Conve	entional		of biotechnology for				1,2			
	metho	-	nprovement, Pedegree	8	8	c	rop ir	nprove	ment		
			ing, Mutation breeding, o improvement. Crop								
		-	ngineering, transgenesis								
Practical			lant root, Bio inoculant:	3	30	D	evelo	p knov	vledge	on	1,2,
Tractical	1	, nom p	, =		-			1	5		-,-,

mass production of Rhizobium,	plant tissue culture
2. Tissue culture media preparation,	laboratory
3. Callus and suspension cultures: initiation	
and maintenance of callus and suspension	
cultures,	
4. Tissue and micro propagation, suspension	
culture, callus formation, regeneration,	
production of haploids, protoplast culture and	
somatic	
hybridization	

- R1. Singh B. D. Biotechnology; Expanding Horizon. 20th edition. Kalyani Publisher; 2020.
  R2. Lindsey K. Plant Tissue Culture Manual: Supplement 1. 2nd edition. Springer, 1999.
  R3. Razdan M K. Introduction to Plant Tissue Culture. 3rd edition. Oxford & IBH Publishing; 2019.

#### OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/33809459/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Illustrate on basic techniques and concepts of plant tissue culture.	1,2,3					
2	Describe different methods for transformation of plants or plant cells, including their specific advantages and applications,	1,2,3					
3	Elaborate on somatic hybridization and associated techniques	1,2,3					
4	Explain on the methods of genetic engineering technology.	1,2,3					
5	Apply the concepts of biotechnological advances for crop improvement through genetic engineering technologies.	1,2,3					

				SEMESTER -	- V							
Course T	Title			Medical	Biote	chn	olo	gy				
Course c	ode	231	BSBT312R	Total credits:4	L	T	1	P	S	R	O/F	C
		231	DSD1312K	Total hours: 45T+301	P 3	0		2	0	0	0	4
Pre-requ	isite		Nil	Co-requisite					Ni	l		
Program	ıme			Bachelor of Sci	ence ir	ı Bio	oteo	chnolo	ogy			
Semest	er		V semester of first year of the programme									
Cours	e	1. Introduce the application of biotechnology in the field of medical science.										
Objectiv	ves	2. To make the students understand about gene therapy, stem cells, cancer biology										
		and infectious diseases of human.										
		3.	3. Develop skill on handling human pathogens, AFB staining method, Identifying of									
CO1		pathogens using VDRL and Widaltests.  Learn the utilization of medical biotechnology within the realm of medical science.										
CO2					0105)	77 16111		iic rea	1111 01 1	nearec	ar serem	· · ·
		Explain the process of gene therapy.  Ability to provide an introduction to stem cell varieties, delve into the origins of stem										
CO3		cells, and outline their distinctive characteristics.										
		Explore on cancer biology by shedding light on the predisposing factors that contribute										
CO 4		to the development of cancer.										
CO 5		1	_	node of infection and in	fection	us di	sea	ises.				
Unit-No.		Content			Cont	act		Lea	rning	Outco	me	KL
					Ho	ur						
I	1			iotechnology and its	10	)	Explain medical 1,					1,2
			ıman Genome									
II	1			on Genes Targeted for	9		Describe gene therapy 1					1, 2
TTT		Ther		T	1.0			D1-	:4	11		1
III	1			Types of Stem Cells, roperties of Stem Cells	10 Explain stem cell							1, 2, 3
IV	Canc			troduction, Types of				Expla	in canc	er biol	ngv	1, 2,
1,4				ctors for cancer, Cellular	8			2		-1 0101	~6)	3
	1			mor formation, Methods								
	1		•	Freatment of cancer -								
			erapy and Radi									
V		obial		Human – mode of				-	in infe	ctious		1, 2,
	1			oidemiology and control itis – B, Rabies, HSV -				diseas	ses			3,
	1				8							
	1	1, STD (sexually transmitted disease), TB, Plague, Aspergillosis, Histoplsmosis,										
	Cryptococcosis, Malaria, Amoebia											
Practical	1. St	tudy c	of Mycobacterio	um tuberculosis byAFB				Devel	lop kno	wledge	e on	1,2,
		_	ethod.		30	)		Medio	cal biot	echnol	ogy	3,4
		_		isease by using VDRL								
		. 3.Stu daltesi	-	ella typhi by using								
	VV IC	ianesi	<u> </u>									

- **R1**. Strachan T, Andrew P. Human Molecular Genetics. 2nd Edition. Wiley and sons; 1999. **R2**. Mims C. et al. Medical Microbiology. 3rd Edition. Mosgy Inc. Publication, 2004.
- **R3**. Balaji S. Nanobiotechnology, 1st edition. Neha Publishers & Distributors, 2021.

## **OTHER LEARNING RESOURCES:**

 $\underline{https://pubmed.ncbi.nlm.nih.gov/32917468/}$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Learn the utilization of medical biotechnology within the	1,2,3						
1	realm of medical science.	1,2,3						
2	Explain the process of gene therapy.	1,2,3						
	Ability to provide an introduction to stem cell varieties,							
3	delve into the origins of stem cells, and outline their	1,2,3						
	distinctive characteristics.							
	Explore on cancer biology by shedding light on the							
4	predisposing factors that contribute to the development of	1,2,3						
	cancer.							
5	Elaborate on the mode of infection and infectious diseases.	1,2,3						

			SEMESTE	R – V							
Course	Title		Research Metho	dology	, Bi	ioethi	ics at	nd IPF	₹		
Course	code	23BSBT313R	Total credits:3	L	T	P	S	R	O/F	C	
			Total hours: 45T	3	0	0	0	0	0	3	
Pre-requ		Nil	Co-requisite					Nil			
Prograi			Bachelor of Science in Biotechnology								
Semes			V semester of th	•							
Cour			search objectives, de	esign, m	neth	odolo	gy, a	analysi	is includin	ig types of	
Object	ives	researches									
		_	out IPR and ways of i	ts prote	ctio	n alo	ng w	ith the	laws and	regulations	
		associated with the process.									
		_	3. Explain moral and ethical issues associated with researches including various								
CO.1	1	conventions		. 1		41	1.1	1		1.	
CO1		_	rate research objectives		n, m	ietnoc	iolog	y, anai	ysis and re	searcn.	
CO2	•		ection and sampling m		tion	1		th tha	larva and	ragulations	
CO3		associated with the	rights and ways of its	s protec	uor	i aion	ıg W1	ш те	iaws and	regulations	
CO 4	1		e process. narks and geographica	1 indicat	tion	e and	nroce	es of	ohtaining t	hem	
CO											
Unit-	<u> </u>	Cont		ated with researches including various    Contact   Learning Outcome					KL		
No.		Cont		Hou		Lear ming Outcome			IXE		
I	Introd	uction to Resea	arch Methods and			Expla	in lite	rature	search, gap		
_	Metho	odology- Format of t	thesis and dissertation,			-			question,		
	Resea				l .			nypothesis			
			search, Significance of			_		resear	ch		
	resear	· 1	methods versus	10		metho	odolog	gy		1,2	
	1	•••	nd Scientific methods,								
	design	•	the research Problem and Research Scientific Methods, Hypotheses								
	_		on, Various Steps in								
	1		Types of Research;								
	Resea	rch Purposes - Rese	earch Design - Survey								
		rch –Case Study Res									
II	1		oling Design- Sources			_			ction an		
	Procee	Oata: Primary Da dure Questionna	•			presei	ntatio	1			
		iments – Design	•	9						1, 2	
	1 *	_	Merits and Demerits -								
	_		Procedures – Sampling								
	Errors										
III	1		al Property - Concept					R, and			
	1		, Patents etc., kinds			conve	ntion	8			
	1	tellectual Property, Economic importance tellectual Property. International Scenario:									
			leading international	10						1, 2, 3	
	1		intellectual property	10						1, 4, 3	
	-		onvention, Universal								
		•	e Paris Convention,								
			ectual Property Rights								
13.7		ization (WIPO) and Introduction to				E 1	in +	James ::1	ra and CI		
IV			Trademarks and ations - Registration of	8		Ехріа	ın ıra	uemark	s, and GI		
	-	-	f Registered trademark							1, 2,	
		_	pellations of Origin,							3,	
				•							

	Indication of Source and geographical Indication			
V	Bio-ethics- Purpose and scope, Principles,		Explain Bioethics	1, 2,
	Medical	8		3,
	ethics, Perspectives and methodology, Moral and			
	ethical issues in Biotechnology			

- R1. Bendat and Piersol, Random data: Analysis and Measurement Procedures. 4th edition. Wiley Interscience, 2001. R2. Cornish W.Ret al. Intellectual Property. 8th edition. Sweet & Maxwell, London; 2013 R3. Keeling D. et al. Kerly's Law of Trade Marks and Trade Names, 16th Edition, Sweet & Maxwell, 2017.

## OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/32917468/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain and illustrate research objectives, design, methodology, analysis and research.	1,2,3							
2	Describe data collection and sampling methods.	1,2,3							
3	explain property rights and ways of its protection along with the laws and regulations associated with the process.	1,2,3							
4	Understand trademarks and geographical indications and process of obtaining them.	1,2,3							
5	Explain moral and ethical issues associated with researches including various conventions	1,2,3							

			SEMESTER -	- V									
Cours	e Title		Wild life conserva		and Ma	nage	ement						
Cours	e code	23FSZO501R	<b>Total credits: 3</b>	L	T	P	S	R	O/F	С			
			Total hours: 45T	3	0	0	0	0	0	3			
Pre-re	quisite	Nil	Co-requisite				Ni	il					
	amme		Bachelor of Scie										
	ester		Fall/ V semester of thi										
Cou			tand the ecological	princi	iples th	at f	orm t	he ba	sis of v	vildlife			
Objec	ctives	conservation.											
			<ol> <li>To learn various techniques for assessing and monitoring wildlife biodiversity.</li> <li>To comprehend the significance of genetics in the conservation of wildlife</li> </ol>										
		_	nend the significance	oi g	genetics	ın t	the co	nservai	tion of v	vilalite			
		species.	strategies for resolv	in a	aanflist	, hat	11100m	humar	. aativiti	as and			
		wildlife con	-	mg (	COMMIC	s DCI	ween	Hulliai	i activiti	es and			
			nowledge of the legal	l and	nolicy	frai	newor	ks ons	zerning v	vildlife			
		conservation		unu	Policy	11 11	11 011	501	, , , , , , , , , , , , , , , , , , ,	. 1141110			
CO	01		orinciples that underpin	wild	life con	serva	tion ef	forts.					
CC			ques for assessing and r						•				
CC			genetics in wildlife con										
CC	)4	Explain the strategies for mitigating conflicts between human activities and wildlife											
		conservation goals.											
CC	)5	Describe the legal a	nd policy frameworks t	hat go	overn w	ildlif	è cons	ervatio	n				
Unit-		Con	tent		Contac	t	Learn	ing O	utcome	KL			
No.					Hour								
I	_	_	Wildlife Conservat	- 1			Inderst	_		the			
	1	_	al principles, ecosys	- 1	10				ecological	1 I /			
			ions, population dynam	ncs,		principles that wildlife conserv							
II		requirements, and l	and Monitoring Wild	11:60					cribe and	1			
11		iques for Assessing ersity:	and Monitoring who	ime			pply	to des	various				
		·	on estimation techniq	ues	8	1 1	echniqu	ies	for				
			ote sensing, and GIS		U		_		ssessment				
	l	e monitoring.	Stabing, and Gio	***			nd mor	-					
III			ife Conservation: Gen	etic					the role	;			
			ics, conservation genet		10			ى mporta		-			
	genetic	c drift, gene flow, in	breeding depression, an	ıd	10	g	enetics	in	wildlife	1,2			
	genetic	management of sm	all populations.			c	onserva	ation.					
IV		O	tween Human Activi	ities			•		elop and	1			
		ildlife Conservatio					xplain		egies to				
	l		auses and impacts, con	- 1	10		nitigate		conflicts	$\perp$ 1.2			
	l	~	nunity-based conservat	ion,			etween		human	1			
	and su	stainable developme	ent practices.						wildlife	;			
17	Lagar	and Dali E	10 m ovvovles :- 117°1	11 <b>:</b> ¢.			onserva		' +1a a 1 1				
V	_	and Policy Fr rvation:	ameworks in Wild	ше				•	the legal				
			and agreements, nation	nal			na poi iat g	-	meworks wildlife				
			and agreements, namer in a management police		7		onserva		vv 11U111C	1,2			
	wildlif	-					OHSCI V	atiOII.					
	mecha	· ·	one, and omoreon	1011t									
	meena	11101110.											

- 1. "Principles of Conservation Biology" by Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.
- 2. Conservation Biology: Foundations, Concepts, Applications" by Fred Van Dyke and Rachel L. Lamb
- 3. "Essentials of Conservation Biology" by Richard B. Primack

#### **Reference Books:**

- 1. "Wildlife Ecology, Conservation, and Management" by John M. Fryxell, Anthony R. E. Sinclair, and Graeme Caughley.
- 2. "Fundamentals of Conservation Biology" by Malcolm L. Hunter Jr. and James P. Gibbs.
- 3. "Conservation Genetics: Case Histories from Nature" by John C. Avise and John L. Hamrick.

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain ecological principles that underpin wildlife conservation efforts.	1,2,3						
2	Describe the techniques for assessing and monitoring wildlife biodiversity.	1,2,3						
3	Describe the role of genetics in wildlife conservation.	1,2,3						
4	Explain the strategies for mitigating conflicts between human activities and wildlife conservation goals.	1,2,3						
5	Describe the legal and policy frameworks that govern wildlife conservation	1,2,3						

SEMESTER – V														
Course T	itle		T	oxicolog	gy									
Course c	ode	23FSFS501R	<b>Total credits: 3</b>	L	T	P	S	R	O/F	C				
_			Total hours: 45T	3	0	0	0	0	0	3				
Pre-requ		Nil	Co-requisite		<b>D.</b>		N	il						
Program			Bachelor of Sc											
Semest			Fall/ V semester of t						.1 1					
Cours		1 -	e fundamental princ , metabolism, and e	-				_		_				
Objectiv	ves	organisms.	, metabolishi, and e	xcretion	(AD	WIE) C	or toxi	c subs	tances in	nving				
			proficiency in anal	lytical	techn	ianes	used	for	the det	ection,				
			on, and characteri	-		_				ogical,				
		_	ital, and occupational			OMIC	Биови	ances	m olor	ogicui,				
CO1			ion of toxicological p											
CO2		Classify different ty	<u> </u>	1										
CO3		1	ciated with exposure	to toxic	subst	ances.								
CO4			nism of absorption,				lism,	and ex	cretion of	ftoxic				
		substances within th	•											
CO5			al knowledge to as	sess and	l ma	nage	risks	in env	ironmenta	al and				
	ı	occupational setting												
Unit-		Conte	nt	Contac	t	Le	arning	g Outc	ome	KL				
No.	-			Hour	<u> </u>	1 .	.1		1 1					
I	Inti	roduction to Toxico	-			xplain			ndational xicology,					
			and scope of		1 *	inciple								
		toxicology,	1 1				_		ory and field, the					
		• History and	•	10	- 1	efinitio			cope of	1 1 /				
		<ul><li>toxicological pr</li><li>Relationship b</li></ul>	-			xicolo		and	1					
		•	detween dose and						dose and					
		response				sponse	•		<b></b>					
II	Cla	ssification of Toxic	ants			_		erent	types of	•				
		• Types of tox	cicants: Chemical,		to	xicant	s, ur	dersta	nd their					
		biological, and	physical	0	sc	sources and routes of								
		• Sources and e	exposure routes of	8	ех	posur	e, and	d desc	cribe the	1,2				
		toxicants			pr	inciple	es of	toxic	kinetics					
			and toxic dynamics			nd toxi								
III	Ris	k Assessment and N	_						ssociated					
		• Principles of ris					exposi		o toxic					
		Hazard identific				bstanc		by	applying					
		characterization			-	_		risk as	sessment,	1				
		• Dose-response		10	- 1	cludin entific	_	daaa	hazard	112				
		<ul><li>Exposure assess</li><li>Risk characteriz</li></ul>				sessm		uose	response exposure					
		management	anon and			sessm		and	-					
		management				aracte	- 1		and					
						anagei			unu					
IV	Me	chanisms of Toxicit	ty					mecha	nisms of	•				
		Absorption of to	•			sorpti			tribution,					
		•	toxic substances	10		metabolism, and excretion of 1,2								
			toxic substances		toxic substances within the									
		• Excretion of tox	cic substances		bo	ody, in	cludir	g the	processes					
	ı							-						

	Biotransformation and		of biotransformation and	
	bioaccumulation		bioaccumulation.	
V	Toxicology in Environmental and		Utilize toxicological	
	Occupational Settings		knowledge to assess and	
	Environmental toxicology: Impact		manage risks in environmental	
	on ecosystems and human health	7	and occupational settings,	
	Occupational toxicology:	1	understand the impact of	1,2
	Workplace exposure and safety		toxicants on ecosystems and	
	• Regulatory aspects and safety		human health	
	guidelines			

- 1. "Casarett & Doull's Essentials of Toxicology" by Curtis Klaassen and John B. Watkins.
- 2. "A Textbook of Modern Toxicology" by Ernest Hodgson

#### **Reference Books:**

- 1. "Patty's Toxicology" edited by Eula Bingham, Barbara Cohrssen, and Charles H. Powell
- 2. "Molecular, Clinical and Environmental Toxicology" edited by Andreas Luch
- 3. "Toxicology: The Basic Science of Poisons" by Curtis D. Klaassen

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome								
1	Explain the foundation of toxicological principles.	1,2,3								
2	Classify different types of toxicants.	1,2,3								
3	Assess the risk associated with exposure to toxic substances.	1,2,3								
4	Explain the mechanism of absorption, distribution, metabolism, and excretion of toxic substances within the body.	1,2,3								
5	Utilize toxicological knowledge to assess and manage risks in environmental and occupational settings.	1,2,3								

		SEMESTE	ER - V										
Course Title		M	lini Resea	rch									
Course code	23BSBT314R	Total credits: 2	L	T P	S	R	O/F	C					
		Total hours: 16P	0	0 0	8	0	0	2					
Pre-requisite		Co-requisite				Nil							
Programme		Bachelor of S											
Semester		Fall/ V semester of	•										
Course	1	with the essential sk	cills and n	nethods	needeo	l to co	onduct ind	lependent					
Objectives	research.												
	2. Develop a research proposal, formulating research questions, reviewing literatur												
	interpreting data, and understanding the implications of research findings.												
CO1	•	rafting a concise and					sal.						
CO2		research questions, o	-										
CO3		review of relevant li											
CO4	_	data, draw meaning	ful conclu	isions, ai	nd rela	ite res	ults to the	e research					
~~-	question.		2 2 4										
CO5	Develop an awareness of the implications of findings within the scope of the mini												
77 1. 37	research.			· ·				***					
Unit-No.	Con	tent	Contact	Le	arnin	g Out	come	KL					
T	C 6:	1 11 4	Hour	D1	1_11	1	<b>G</b> :						
I	Crafting a concise a		15		crafting a structured	1 2 2 4							
	research proposal, v	•	15	researc	structured	1,2,3,4							
II	Formulating Resear	•					research						
11	Hypotheses in	•					ves, and						
		small groups, ulated research	15	1,2,3,4									
	questions and hypot			hypoth									
III	Use of academic dat			Condu	ct a t	focuse	d review						
111	for literature review						re related						
	literature review on		20		research	1,2,3,4							
	research topic and si			topic.			1 CSCUI CII						
IV	Hands-on practice	•			to inte	rnret d	lata, draw						
1	software, analyse sa	•		meanii									
	interpret the results.	-	10		•		nclusions, s to the	1,2,3,4					
	1			researc									
V	Presentations and o	discussions on the					reness of						
	broader implication				_		f findings						
	research findings,		10		_		f the mini	1,2,3,4					
	implications of the	research findings		researc		-							
	and submit a final re	esearch report.											
	and submit a final re	search report.						<u> </u>					

## **Reference Books:**

R1. Creswell; Research Design: Qualitative, Quantitative, and Mixed Methods Approaches; 5th edition; 2018.

R2. Booth and Colomb; The craft of research; 4th edition, 2016.

## OTHER LEARNING RESOURCES:

https://scholar.google.com/

https://pubmed.ncbi.nlm.nih.gov/

	CO PO Mapping							
SN	Course Outcome (CO)	<b>Mapped Program Outcome</b>						
1	Develop skills in crafting a concise and well-structured research proposal.	1,2,3						
2	Learn to formulate research questions, objectives, and hypotheses.	1,2,3						
3	Conduct a focused review of relevant literature related to the chosen mini research topic.	1,2,3						
4	Learn to interpret data, draw meaningful conclusions, and relate results to the research question.	1,2,3						
5	Develop an awareness of the implications of findings within the scope of the mini research.	1,2,3						

		SEME	STER -	- V						
<b>Course Title</b>		Techno profe	ssional	skill l	III (A	nalyti	cal Bi	ochemi	istry)	
Course code	23BSBT314R	Total credits: 2		L	T	T P S R O				
		Total hours: 601	P	0	0	4	0	0	0	2
Pre-requisite	Nil	Co-requisit	te				N	il		
Programme		Bachelor	of Scie	ence in	Biot	echnol	ogy			
Semester		Fall/ V semeste		•		_	_			
Course	This course prov		_		•	•		•		
Objectives	1	uding buffer prep		, pH n	neasui	ement	, spect	rophoto	ometry, ei	nzyme
		me activity modu								
CO1	_	n how to prepare		r solu	tions	which	coul	d be us	sed in di	fferent
604		ochemical experim		**				0. **		
CO2		derstanding on aci								
CO3		principle of Lar	nbert-E	Beer l	aw v	vith th	e hel	p of c	colorimete	er and
604	spectrophotomete		1_1	4	1	. 1/1: 1	11	N 1 4		
CO4		echanism of enzy				ig Mic	naelis	Menten	equation	•
CO5 Unit-No.		cept of enzyme act		odulat C <b>ontac</b>		Τ.		· O4		KL
Unit-No.	Co	ontent		ontac Hour		Le	arnınş	g Outco	ome	KL
I	<ol> <li>Measure to solutions used.</li> <li>Prepare to titrating acide.</li> <li>Determine to by analysing.</li> <li>Measure different so wavelength standard cure.</li> <li>Perform of measure different concentration.</li> <li>Investigate</li> </ol>	rves. enzyme assays reaction rates substons. the effects hibitors (competit	by cids of cific pare to at crate of cive,	30	es te in pl sp ki	ssential chniqu cludin H pectrop	es g buf hotom and	bioc and c fer pre meas netry,	hts into hemistry concepts, paration, urement, enzyme activity	

## **Reference Books:**

- **R1**. Weyers, Practical Skills in Biomolecular Sciences; 4th edition; Pearson Education India; 2013.
- **R2**. David L. Nelson, Michael Cox. Menninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R3. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.

## OTHER LEARNING RESOURCES:

https://www.sciencedirect.com/science/article/pii/S0003269799943208

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Build concept on how to prepare buffer solutions which could be used in different molecular and biochemical experiments.	1,2,3						
2	Develop basic understanding on acid-base, pH of solution and use of pH meters.	1,2,3						
3	Understand the principle of Lambert-Beer law with the help of colorimeter and spectrophotometer.	1,2,3						
4	Understand the mechanism of enzyme kinetics applying Michaelis Menten equation.	1,2,3						
5	Illustrate the concept of enzyme activity modulation.	1,2,3						

			SEMESTEI	R – VI								
Course Tit	tle			imal Biot	echno	ology						
Course co	de	23BSBT321R	Total credits: 4		L	T	P	S	R	0/		C
			Total hours: 45T+		3	0	2	0	0	0		4
Pre-requis		Nil	Co-requisite					Nil				
Programn			Bachelor of S									
Semester	•		VI semester of the						\ 1	1.		
Course			Animal Cell Culture	•								1 1: .
Objective	es	2. Elucidatio co-operati	n of various cell to	cell intera	ction;	adne	esion	, moi	ility a	na n	neta	ibolic
		•	on. lls on tools and tech	nigues use	d for	anim	al cel	ll cult	hire			
CO1			ion of animal cell cu		u 101	amm	ar cc	ıı cur	iuic.			
CO2			ications of animal		e tec	hnolo	ov v	vith s	special	l refe	erei	ice to
			ins of medical impor		C 100	imoro	<i>5)</i> '	, 1011 ·	эрссіа	1 101	0101	100 10
CO3			ed reproduction tech		l basi	cs of	huma	an fei	tilizat	ion p	oroc	ess.
CO4			view on gene therapy									
CO5			nsics, molecular dia				m ce	ll res	earch a	and b	oio	
	1	processing Technic	ques.									
Unit-No.		Cont	ent	Contact		Lear	ning	Out	come		k	(L
				Hour								
I		oduction, history				cribe			of			
			nent for animal cell		anin	nal ce	ll cu	lture			_	
		are, Animal cell,	10							1	1,2	
		· · · · · · · · · · · · · · · · · · ·	ure, secondary cell in s cell lines,									
	cultu	,	s cell lines, Cell cloning and									
			cultures, Scalingup.									
	Grov	,	Cellline and									
		ntenance, viability										
II		<u> </u>	ell culture		Des	cribe	the c	ell				
	tech	nology in producti	on of	9	cult	ure	ar	ıd	vacc	ine	1	, 2
		differe	ent vaccines and		proc	luctio	n					
	phar	maceutical proteir	ıs.									
III		cture of sper				lain r			ve			
	-		perms and ova of	10		ctures		nd	artific	cial		, 2,
		-	ovulation, in-vitro		ferti	lizati	on					3
	1	lization, culture	• /									
		-	embryos, embryo									
137	trans		overview		Ever	10:50 +1	20.00	nlina	tions	+		
IV	Gen	1.2	pes, applications,	8	_		_	_	tions in g	ene	1	, 2,
	adva		idvantages, tissue,	0	ther		Cuit	ure	m g	CHC		, 2, 3,
		-	7. Transgenic and			⊶P J					•	٠,
	_	-	ansfer technology									
V			ring development		Exp	lain c	ell d	iffere	ntiatio	n,		
			genes and other		_				plicati		1.	, 2,
		elopmental gene	-	8		arious	_					3,
		nation (Drosop	•									
	fore	nsics, bio-terror a	gents, Bio-crimes									
			ical consideration									
	on a	nimal biotechnolo	gy.									

Practical	1. Laboratory safety		Develop knowledge on	
	2. Setting of Animal cell culturelab		animal cell culture and	
	3. Field visit to animal cell culture	30	laboratory	1,2,
	laboratory			3,4
	4. Examination of permanent			
	slide samples and explanation			
	to the observation			
	5. Measurement of cell size.			

#### **Reference books:**

- R1. Satyanarayana U. Biotechnology. 15th edition. Books & Allied Ltd; 2020.
  R2. Singh B. D. Biotechnology; Expanding Horizon. 20th edition. Kalyani Publisher; 2020.
  R3. Brown T. A. Gene Cloning and DNA Analysis: an introduction. 7th edition. John Wiley; 2016.

#### **OTHER LEARNING RESOURCES:**

https://books.google.com/books?hl=en&lr=&id=K8eaAgAAQBAJ&oi=fnd&pg=PA1&dq=animal+biotec hnology&ots=IZMN9XSg X&sig=QibBdcSBHILUhmqwNASdWXWHnfg

CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the evolution of animal cell culture.	1,2,3					
2	Describe the applications of animal cell culture technology with special reference to vaccines and proteins of medical importance.	1,2,3					
3	Illustrate on assisted reproduction techniques and basics of human fertilization process.	1,2,3					
4	Describe the overview on gene therapy and its techniques.	1,2,3					
5	Explain DNA forensics, molecular diagnostics, cloning, stem cell research and bio processing Techniques.	1,2,3					

Pre-requisite   Nil   Co-requisite   Nil   Nol   Nil			SEMESTER	R – VI								
Pre-requisite   Nil   Co-requisite   Nil	Course Title			al Biot	echn	ology						
Pre-requisite   Nil   Co-requisite   Nil   Programme   Bachelor of Science in Biotechnology	Course code	23BSBT322R				T		S	R	O/I	F	C
Programme   Semester   V1 semester of third year of the programme				30P	3	0	2		0	0		4
Semester   VI semester of third year of the programme		Nil						Nil				
Course Objectives												
Objectives   2. To make the student understand fermenters, sterilisation techniques, cell grow kinetics, bioreactor production of Enzymes, Organic acids-citric acid, Amino aci glutamic acid, Antibiotics-Penicillin, Solvent-Ethanol, Vitamins-Riboflavin at SCP.   3. Develop skill on Immobilization study by sodium alginate method (yeas development of bioinoculant, production of yoghurt.   CO1   Trace the historical evolution of fermentation, highlighting key milestones a advancements in the understanding and application of this process over time.   CO2   Discuss the formulation of media in the context of a media preparation process, and delvinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.   Co1   To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.   CO4   Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.   Co5   To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.   Unit-No.   Content   Contact   Hour   Learning Outcome   KL   Hour   Describe use of   Describe use of   Describe use of   Describe culture and and continuous culture system, types of   fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization   Production of process   Variables (Temperature, pH and DO)   Explain bioreactor   Variables (Temperature, pH and DO)   Variables (Temperature, pH and DO)   Unit of microbial products:   Explain production of   Explain bioreactor   Explain production of   Explain bioreactor   Explain production of   Service   Explain production of   Service   Explain production of   Service   Servi		1 7 1										
kinetics, bioreactor production of Enzymes, Organic acids-citric acid, Amino aci glutamic acid, Antibiotics-Penicillin, Solvent-Ethanol, Vitamins-Riboflavin a SCP.  3. Develop skill on Immobilization study by sodium alginate method (yeas development of bioinoculant, production of yoghurt.  CO1 Trace the historical evolution of fermentation, highlighting key milestones a advancements in the understanding and application of this process over time.  CO2 Discuss the formulation of media in the context of a media preparation processes, and debrinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.  CO3 To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing.  Screening of industrially important microbes. Strain improvement, Inoculum development  Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector Design, parts and their function. Types of bioreactor-estr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Explain production of Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  3, ethanol etc.  3, ethanol etc.				_		•				11		41.
glutamic acid, Antibiotics-Penicillin, Solvent-Ethanol, Vitamins-Riboflavin a SCP.  3. Develop skill on Immobilization study by sodium alginate method (yeas development of bioinoculant, production of yoghurt.  CO1 Trace the historical evolution of fermentation, highlighting key milestones a advancements in the understanding and application of this process over time.  CO2 Discuss the formulation of media in the context of a media preparation process, and delvinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.  CO3 To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-estr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Explain production of Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc. 3, 4	Objectives								•		_	
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development of bioinoculant, production of yoghurt.  CO1 Trace the historical evolution of fermentation, highlighting key milestones a advancements in the understanding and application of this process over time.  CO2 Discuss the formulation of media in the context of a media preparation process, and delvinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.  CO3 To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No.  Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-estr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  3, ethanol etc.			ll on Immobilizatio	n stud	v by	v sodit	ım a	lginat	e me	thod	(v	east).
CO1   Trace the historical evolution of fermentation, highlighting key milestones a advancements in the understanding and application of this process over time.    CO2   Discuss the formulation of media in the context of a media preparation process, and delvinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.    CO3   To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.   CO4   Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.   CO5   To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.   Unit-No.   Content   Contact Hour   Learning Outcome   KL Hour		_						8	- 1110		()	,
Discuss the formulation of media in the context of a media preparation process, and delvinto various sterilization techniques employed in the production of media for application such as microbiology or cell culture.  CO3 To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  Describe taring the key compone and plication functionality observed microbial products: Explain production of enzymes, antibiotics, 1, 2, ethanol etc.  3, 4	CO1						ightin	g ke	y mi	ilesto	nes	and
into various sterilization techniques employed in the production of media for application such as microbiology or cell culture.  CO3  To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4  Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5  To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No.  Content  Contact Hour  Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III  Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV  Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  20  CO4  CO5  CO6  CO6  CO7  CO7  CO7  CO7  CO7  CO7		advancements in the	understanding and a	pplicat	ion o	of this p	roces	s over	time.			
such as microbiology or cell culture.  To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  To Elaborate on the design and functionality of bioreactors, detailing the key componed and functions for biological processes.  Describe use of biotechnology in industry  1,2  Describe culture and growth kinetics  1, 2, Explain bioreactor  1, 2, Explain bioreactor  2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,	CO2	Discuss the formula	tion of media in the c	context	of a	media p	orepar	ation	proce	ss, an	ıd c	lelve
To Elaborate on the design and functionality of bioreactors, detailing the key compone and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  To explain and substitute, substitute, substitute, and mushroom technology represent sustainable desired products, outlining the key contolled environments for biological products, and mushroom technology represent sustainable and environmentally products, and mushroom technology represent sustainable and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Learning Outcome KL  Learning Outcome  KL  Describe culture and growth kinetics  1, 2, and production of process variables (Temperature, pH and DO)  Explain bioreactor  1, 2, and production of enzymes, antibiotics, ethanol etc.  3, ethanol etc.  3, ethanol etc.		I		loyed in	n the	produc	tion o	f med	lia for	appli	icat	ions
and principals involved in creating controlled environments for biological processes.  CO4 Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.  CO5 To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No. Content Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  Screening of industrially important microbes and process of biotechnology in industry and control of process and passed and process and process and passed and process and process and process and process and passed and process and passed and process		-										
Describe the process of producing microbial products, outlining the key steps involved cultivating and harvesting microorganisms to obtain desired products.    CO5	CO3		•	•				_		•	•	nents
cultivating and harvesting microorganisms to obtain desired products.  CO5  To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No.  Content  Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Evalain products. Explain production of enzymes, antibiotics, ethanol etc.  3, ethanol etc.												
To explain about Biofertilizers, biopesticides, and mushroom technology represent sustainable and environmentally friendly approaches in agriculture.  Unit-No.  Content  Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Enzymes, antibiotics, and mushroom technology represent sustainables in agriculture.  Contact Hour  Learning Outcome KL  Describe use of biotechnology in industry  1,2  Describe culture and growth kinetics  1, 2  Explain bioreactor  1, 2, 3  Explain production of enzymes, antibiotics, ethanol etc.  3, 4	CO4	_										
Sustainable and environmentally friendly approaches in agriculture.   Unit-No.   Content   Contact Hour   Learning Outcome   KL	COF											
Unit-No.  Content  Contact Hour  I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Contact Hour  Learning Outcome KL  Explain goutcone State of biotechnology in industry  1,2  Bescribe culture and growth kinetics  1, 2  Explain bioreactor  1, 2, 3  Explain production of enzymes, antibiotics, ethanol etc.  3, 4	COS											
I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,    Hour   Describe use of biotechnology in industry   1,2   Describe culture and growth kinetics   1, 2   Explain bioreactor   1, 2, 3   Explain production of enzymes, antibiotics, enzymes, antibiotics, ethanol etc.   3, 3, 3	Unit No		<u> </u>						nomo.		L	71
I Historical development in fermentation, Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Describe use of biotechnology in industry  1,2  Explain bioreactor  1, 2, 3  Explain production of enzymes, antibiotics, 1, 2, ethanol etc. 3,	OIII-140.								Come		ľ	XL.
Outline of upstream processing. Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Describe culture and growth kinetics  1, 2  Explain bioreactor  110  12  Explain production of enzymes, antibiotics, ethanol etc.  Explain production of enzymes, antibiotics, ethanol etc.  3, 2	I	Historical developme	ent in fermentation.	1104		Describe	e use	of				
Screening of industrially important microbes. Strain improvement, Inoculum development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Screening of industrially important microblum development  Describe culture and growth kinetics  1, 2  Explain bioreactor  1, 2, 3  Explain production of enzymes, antibiotics, ethanol etc.  3, 3,		•		10	b	oiotechn	ology	in in	dustry	,	1	,2
development  II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Describe culture and  9 growth kinetics  1, 2  Explain bioreactor  1, 2, Explain production of enzymes, antibiotics, ethanol etc.  3,		Screening of indu	strially important									
II Media formulation, sterilization, batch and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Describe culture and growth kinetics  1, 2  Explain bioreactor  1, 2,  Explain production of enzymes, antibiotics, ethanol etc.  3,		microbes. Strain impr	ovement, Inoculum									
and continuous culture system, types of fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  and continuous culture system, types of growth kinetics  1, 2  Explain bioreactor  1, 2, 3  Explain production of enzymes, antibiotics, ethanol etc.  3, 3,		development										
fermentation, Stoichiometry of cell growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  fermentation, Stoichiometry of cell growth and kinetics. Methods of Explain bioreactor  1, 2,  Explain production of enzymes, antibiotics, ethanol etc.  3,		*	ŕ						d			
growth and kinetics. Methods of immobilization  III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain bioreactor  1, 2,  Explain production of enzymes, antibiotics, ethanol etc.  3,				9	g	growth l	kineti	cs			1	, 2
III Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain bioreactor  1, 2,  Explain bioreactor  1, 2,  Explain production of enzymes, antibiotics, ethanol etc.  3,			*									
HII Biorector- Design, parts and their function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain bioreactor  1, 2,  Explain bioreactor  1, 2,  8 Explain production of enzymes, antibiotics, ethanol etc.  3,		~	Methods of									
function. Types of bioreactor-cstr. Air lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  10  Explain production of enzymes, antibiotics, ethanol etc.  1, 2,  8  ethanol etc.  3,			1 1 1				1 .					
lift, Bubble column, Packed bed, Tower, monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, ethanol etc.  3  Explain production of enzymes, antibiotics, ethanol etc.  3,			_	10		explain	biore	actor			1	2
monitoring and control of process variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain production of enzymes, antibiotics, ethanol etc.  1, 2, ethanol etc.		· -		10								
variables (Temperature, pH and DO)  IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain production of enzymes, antibiotics, ethanol etc.  1, 2, ethanol etc.  3,												3
IV Production of microbial products: Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid,  Explain production of enzymes, antibiotics, ethanol etc.  1, 2, ethanol etc.  3,		-	-									
Enzymes- amylase, Organic acids-citric acid, Amino acid- glutamic acid, 8 enzymes, antibiotics, ethanol etc. 1, 2, 3,	IV	· •	•			Explain	produ	iction	of			
acid, Amino acid- glutamic acid, ethanol etc.			*	8							1.	, 2,
		•	_						•			
Antibiotics-Penicillin, Solvent- Ethanol,												
Vitamins-Riboflavin and SCP		Vitamins-Riboflavin a	and SCP									
V Biofertilizers, Biopesticides, Mushroom Explain the biofertilizers, 1, 2,	V	Biofertilizers, Biopest	ticides, Mushroom		E	Explain	the bi	oferti	lizers,	,	1,	, 2,
technology, Vermitechnology, Biofuel 8 biotesticides etc. 3,				8	b	oiotestic	ides e	etc.			•	3,
technology, Biodyes, MEOR												
Practical         1. Immobilization study by sodium         Develop knowledge on	Practical	1. Immobilization	study by sodium		Γ	Develop	knov	vledge	e on			

alginate method(yeast),		industrial application of	
2. Bio inoculant: Study of the	30	biotechnology	1,2,
fermenter,			3,4
3. Production of yoghurt by using specific starter culture,			
4. Visit to industry and biotech park and to be submitted along with			
the record			

# **Reference books:**

- R1. PatelAH. Industrial microbiology, 2nd edition. Laxmi Publications; 2022. R2. Crueger and Crueger. Industrial Microbiolgy. 3rd edition. Panima Books; 2004. R3. Satyanarayana U. Biotechnology. 15th edition. Books & Allied Ltd; 2020.

# **OTHER LEARNING RESOURCES:**

https://analyticalsciencejournals.onlinelibrary.wiley.com/doi/abs/10.1002/biot.200900127

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
	Trace the historical evolution of fermentation, highlighting key	
1	milestones and advancements in the understanding and	1,2,3
	application of this process over time.	
	Discuss the formulation of media in the context of a media	
	preparation process, and delve into various sterilization	1.2.2
2	techniques employed in the production of media for	1,2,3
	applications such as microbiology or cell culture.	
	To Elaborate on the design and functionality of bioreactors,	
3	detailing the key components and principals involved in	1,2,3
	creating controlled environments for biological processes.	
	Describe the process of producing microbial products, outlining	
4	the key steps involved in cultivating and harvesting	1,2,3
	microorganisms to obtain desired products.	
	To explain about Biofertilizers, biopesticides, and mushroom	
5	technology represent sustainable and environmentally friendly	1,2,3
	approaches in agriculture.	

			SEMESTER – VI										
Course T	itle			He	rbal N	1edi	cine						
Course c	ode	23FS	SBO601R	Total credits: 3			T	P	S	R	O/F	C	
	• •		2742	Total hours: 45T		3	0	0	0	0	0	3	
Pre-requ			Nil	Co-requisite	7 •	• 1	D: 4		N	il			
Program Semest			•	Bachelor of S pring/ VI semester						mmo			
Cours		1.		and the pharmacolog									
Objectiv	_	2.		e methods of formul	_	_				Piana			
J		3.	To evaluate	e scientific literature	on he	rbalı	medi	cine.					
		4.	To discuss	the clinical applicat	ons of	herb	oal m	nedicin	ie.				
		5.	_		ethical issues related to herbal medicine.								
CO1 Discuss pharmacological properties of CO2 Explain the methods of formulation of													
CO2							icine	<b>).</b>					
CO3				literature on herbal									
CO4 CO5				plications of herbal i			nedio	rine					
Unit-	Understand the legal and ethical issues of Content					tact			arning	Outo	come	KL	
No.								20.		, 0 410			
I	Pha	rmacol	ogical	Properties of	1		D	escribe	e the p	harm	acological		
	Med	dicinal					properties and mechanis						
	pharmacognosy, bioactive compounds in				9					ompounds	1,2		
	plants, mechanisms of action, examples of commonly used medicinal plants.			`		in	medic	cinal pl	lants.				
11							D		44	1	ledge of		
II				lation of Herbal nethods, preparation									
	of	extrac		lation techniques			different extraction and formulation techniques used						
			*	infusions, tablets,		9			l medi		iues asea	2,3	
	1 '	sules),	standardiz										
	prod	ducts.											
III				ic Literature on		9	Cı	te and					
		bal Me									literature		
			_	s, critical appraisal			re	lated t	o herb	al med	licine.	4,5	
				ematic reviews, tation of results.									
IV		a-anarys nical	Applicatio			9	D	iscuss		he	clinical		
-,		dicine:	търпешто					plicati		safe			
	Use	of herb	al medicine	in treating common			_	_			medicines	2.4	
				ased applications,			in	treatin	ng vari	ous co	onditions.	3,4	
	safety and efficacy, interaction with												
			al medicines		1					1 4			
V	V Legal and Ethical Issues in Herbal Medicine:				9					scuss the			
	Regulatory frameworks, quality control,						-			ues related esearch of			
	_	llectual						_	nedicin		cocarcii Ul	1,2	
			1 1	earch and practice,				11		• •			
				•									
	patient consent.				1								

# **REFERENCE BOOKS:**

**R1**. Felrow and Avila; The Complete Guide to Herbal Medicines; 1st edition; Springhouse Publishing Co ,U.S.; 2000.

**R2.** Mills and Bones; Principles and Practice of Phytotherapy: Modern Herbal Medicine; 2nd edition; Churchill Livingstone; 2003.

# OTHER LEARNING RESOURCES:

https://www.jstor.org/stable/24103844

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Discuss pharmacological properties of medicinal plants.	1,2,3							
2	Explain the methods of formulation of herbal medicine.	1,2,3							
3	Evaluate scientific literature on herbal medicine.	1,2,3							
4	Discuss clinical applications of herbal medicine.	1,2,3							
5	Understand the legal and ethical issues on herbal medicine.	1,2,3							

			SEMESTER	R – VI									
Course T	Title		Comm	unity N	utri	tion							
Course c	ode	23FSFD601R	Total credits: 3	L	Т	P	S	R	O/F	C			
_		2-74	Total hours: 45T	3	0	0	0	0	0	3			
Pre-requ		Nil	Co-requisite		-			il					
Program		Bachelor of Science in Biotechnology											
Semest				ster of third year of the programme									
Cours				nciples and practices of nutritional epidemiology.									
Objectiv	ves		2. To assess the nutritional needs of communities.										
		<ul><li>3. To implement and evaluate community nutrition programs.</li><li>4. To understand the role of advocacy and policy development in improving</li></ul>											
				vocacy	and	poncy	deve	юринси	it iii iiiip	ioving			
		· · · · · · · · · · · · · · · · · · ·	<ul><li>community nutrition.</li><li>To develop strategies for effective nutrition education and intervention programs.</li></ul>										
CO1			es and practices of n						ntion prog	,rams.			
CO2			nutrition needs using					nodolos	gies.				
CO3			uate community nutr					- 20108	ə: <b>'</b>				
CO4			ly advocacy and poli				nprov	e comr	nunity nut	rition.			
CO5			nent effective nutrition		_		_						
Unit-				Contac				g Outc	-	KL			
No.				Hour									
I	Nut	ritional Epidemiol	ogy		]	Explain	the	princi	ples and				
		<ul> <li>Principles</li> </ul>	of nutritional		]	practices	5 (	of 1	nutritional				
		epidemiology			-   (	epidemi	ology.	·					
		<ul> <li>Study design</li> </ul>	s in nutritional	9						1,2			
		epidemiology								1,2			
		• Measurement of											
			arkers in nutritional										
**	-	epidemiology						•.					
II	Cor	nmunity Nutrition						-	nutrition				
		nutrition needs	sessing community		- 1	and met			riate tools				
			s and nutritional		'	and men	ilouoi	ogies.					
		status assessmen		9						2,3			
		• Use of	anthropometry,										
		biochemical, an											
		• Interpretation of											
III	Cor	nmunity Nutrition		9		Impleme	ent	and	evaluate				
		<ul> <li>Planning and in</li> </ul>				commun			nutrition				
		nutrition progra	-			program	-						
		Monitoring and	evaluation of										
		nutrition progra								3,4			
		• Case studies of											
		community nuti											
		• Challenges in ir											
	nutrition programs			_									
IV	Adv	vocacy and Policy I	_	9									
			acy in community							2.4			
		nutrition								3,4			
		Policy developm     Strategies for in	•										
		Strategies for in	ifluencing nutrition										

	policy  • Case studies of nutrition advocacy and policy change		
V	Nutrition Education and Intervention	9	
	Programs		
	Principles of nutrition education		
	Developing and implementing nutrition education programs		4,5
	Behaviour changes communication strategies		Í
	• Evaluating the effectiveness of nutrition interventions		

# **Reference Books:**

R1. Ross et al; Modern Nutrition in Health and Disease; 8th edition; Lea & Febiger,U.S; 1993

R2. Battle; "Essentials of Public Health Biology: A Guide for the Study of Pathophysiology; 1st edition; Jones and Bartlett Publishers, Inc; 2008.

# OTHER LEARNING RESOURCES:

Coursera, YouTube

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain the principles and practices of nutritional epidemiology.	1,2,3							
2	Assess community nutrition needs using appropriate tools and methodologies.	1,2,3							
3	Implement and evaluate community nutrition programs.	1,2,3							
4	Understand and apply advocacy and policy development to improve community nutrition.	1,2,3							
5	Develop and implement effective nutrition education and intervention programs.	1,2,3							

SEMESTER – VI										
Course 7	Title		Natural P	roduct Ch	emistr	y				
Course	code	23FSCH601R	Total credits:3	L T	P	S	R	O/F	C	
		23F3CH001K	Total hours: 45T	3 0	0	0	0	0	3	
Pre-requ	isite	Nil	Co-requisite			1	Nil			
Progran	nme		Bachelor of Sci	ence in Bi	otechn	ology				
Semest	ter		VI semester of fir			_				
Cours		1 ^	e students with an unde	_			•	•		
<b>Objectives</b>			arize students with the s	tructural d	iversity	, bios	ynthes	is, and bic	ological	
			of natural products.						_	
			knowledge about the	e extracti	on, isc	olation	n, and	structur	al	
			n of natural products.	• • •	2 :					
CO1			ctural features and class							
CO2			osynthetic pathways of	• •		•				
CO3			ods used for the extraction					ducts.		
CO 4			for the structural elucid					.1		
CO 5	, 	Discuss the biolog	gical activities and phari	Contact			natura		s. KL	
No.		Con	tent	Hour		earm	ng Ou	come	KL	
I I	Intro	oduction to	Natural Products:	1001	Classit	fy Na	tural Di	oducts	1,2	
1			nificance of natural	10	Classii	ly Iva	iurai i i	oducis	1,2	
			n of natural products.							
	Prim		ondary metabolites.							
		•	roduct sources: plants,							
	1	oorganisms, and m	-							
II			Natural Products:	9	Explai	1, 2				
	Bios	ynthetic pathwa	ays: Primary and		Pathwa					
	seco	ndary metabolis	m., Shikimic acid							
	1 ~	•	way. Mevalonate and							
			athways. Alkaloid							
		nthesis.								
III			olation of Natural	10			action		1,	
		oducts:			Isolati	on Te	chniqu	es	2, 3	
		_	: Solvent extraction,							
		n distillation, ar action., Isola	nd supercritical fluid tion techniques:							
		,	thods (TLC, HPLC,							
		Purification techn								
IV		ctural Elucida	*		Elucid	ate St	ructure	es Using	1, 2,	
'			oic methods: UV, IR,	8			ic Met	•	3	
		R, and Mass Sp			1	1				
		•	erpenoids, alkaloids,							
	flavo	onoids, and steroid	S.							
V	Biolo	ogical Activities	of Natural Products:		Evalua	te Bi	ologica	.1	1, 2,	
	Antil	bacterial, antifur	ngal, antiviral, and		Activit	ties			3,	
			Natural products as	8						
	thera	peutic agents.								
<del></del>		<del></del>								

# **REFERENCE BOOKS:**

**R1**. Bhatt; Natural Products: Chemistry and Applications; 10th Edition, Narosa Publication; 2016. **R2**. Xu, Ye and Zhao; Introduction to Natural Products Chemistry, 1st Edition, CRC Press; 2011.

# OTHER LEARNING RESOURCES:

https://pubmed.ncbi.nlm.nih.gov/33297511/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the structural features and classifications of various natural products.	1,2,3							
2	Understand the biosynthetic pathways of primary and secondary metabolites.	1,2,3							
3	Explain the methods used for the extraction and isolation of natural products.	1,2,3							
4	Apply techniques for the structural elucidation of natural products.	1,2,3							
5	Discuss the biological activities and pharmacological potential of natural products.	1,2,3							

		SEMESTE	R – VI										
Course Title		]	Dissertat	ion									
Course code	23BSBT324R	Total credits: 5	L	T	P	S	R	O/F	C				
		Total hours: 30R	0	0	0	0	30	0	5				
Pre-requisite	Nil	Co-requisite					Nil						
Programme		Bachelor of S	Science i	ı Bio	techn	ology	•						
Semester		Fall/ V semester of											
Course	1. Equip students with the essential skills and methods needed to conduct independent												
Objectives	research.												
	_	2. Develop a research proposal, formulating research questions, reviewing literature,											
		nd understanding the	implicat	ions	of res	earch	findin	gs.					
CO1	Develop Research l	*											
CO2	Conduct Independe												
CO3		Review and Data An	alysis										
CO4		and Communication											
CO5		onduct and Contribu											
Unit-No.	Cont	tent	Contac	t	Lea	arnin	g Out	come	KL				
	·		Hour	4_				0.1					
I	Crafting a concise a					•	ls in o	1 2 2 4					
	research proposal, v	~	15					structured	d 1,2,3,4				
	research proposal on			research proposal.  Learn to formulate research									
II	Formulating Resear												
	Hypotheses in	small groups,	15	1 ~			bjecti	ves, and	1,2,3,4				
	$\mathcal{C}$	ulated research	hypotheses.										
III	questions and hypotl Use of academic dat				andria	t o 1	Faarraa	d review	-				
111	for literature review,							re related					
	literature review on		20					research	1,2,3,4				
	research topic and su				pic.	Hose	.1 1111111	research					
IV	Hands-on practice	<u> </u>		_		o inte	rnret d	lata, draw	-				
1 V	software, analyse sa	· · · · · · · · · · · · · · · · · · ·			earii 0 neanin		•	iclusions,					
	interpret the results.	impie data sets allu	10			_		to the	1,2,3,4				
	interpret the results.				esearc			, to the					
V	Presentations and o	liscussions on the						reness of	+				
	broader implication							findings					
	research findings,		10		_			the mini					
	implications of the				esearc		r, 3,						
	and submit a final re	_											
		1	<u> </u>						_1				

# **Textbooks:**

# **Reference Books:**

R1. Creswell; Research Design: Qualitative, Quantitative, and Mixed Methods Approaches; 5th edition; 2018.

R2. Booth and Colomb; The craft of research; 4th edition, 2016.

# OTHER LEARNING RESOURCES:

https://scholar.google.com/

https://pubmed.ncbi.nlm.nih.gov/

	CO PO Mapping								
SN	Course Outcome (CO)	<b>Mapped Program Outcome</b>							
1	Develop skills in crafting a concise and well-structured research proposal.	1,2,3							
2	Learn to formulate research questions, objectives, and hypotheses.	1,2,3							
3	Conduct a focused review of relevant literature related to the chosen mini research topic.	1,2,3							
4	Learn to interpret data, draw meaningful conclusions, and relate results to the research question.	1,2,3							
5	Develop an awareness of the implications of findings within the scope of the mini research.	1,2,3							

		SEMESTER	R – VI							
Course T	Citle Techn	o-professional skill	IV (Foo	d pac	ckagin	g tecl	nolog	<b>y</b> )		
Course c	ode 23BSBT323R	Total credits: 2	L	T	P	S	R	O/F	C	
		Total hours: 60P	0	0	2	0	0	0	2	
Pre-requ		Co-requisite				Ni	il			
Program		Bachelor of Sc								
Semest		ring/ VI semester o						1		
Cours		d the principles and practices of food packaging technology, are importance, functions, and advancements in packaging materials and								
Objectiv	_	importance, function	is, and ac	ivanc	ements	s in pa	ickagii	ig materia	is and	
		systems.  3. Gain knowledge of different packaging materials, systems for fresh and								
		processed food groups, and emerging trends in food packaging technology.								
CO1	Discuss the importan	<u> </u>								
CO2	Explain the role of di									
CO3	Describe various foo									
CO4	Describe various foo	1 0 0 1			proces	s food	d group	os.		
CO5	Describe the advance								<b>T</b> 7 7	
Unit-	Conten	t	Contact Hour	t	Lea	rning	<b>Outc</b>	ome	KL	
No.	Introduction to Fo	advetion to Food Baskaging.			ıdents	will	be	able to		
1		roduction to Food Packaging: ortance, functions, and role of food			alyze	th		historical		
	packaging, historical			•			olution of			
	evolution of food packag	•	6		•			lentifying	1,2	
				ke	•	_	stones	and		
				inr	ovatic	ns th	at hav	e shaped		
				the	e field.					
II	Packaging Materials	s: Types of			ıdents					
	packaging materials,				aluate		prop			
	Properties and suitabil	ity for different				_		materials		
	food products		6		-	-		ability for	2,3	
				_	ecific oducts	typ bas	_	of food on their		
								nd barrier		
					opertie		ncai, a	nd burner		
III	Food Packaging System	ms: Overview of	6		udents		be	able to		
	packaging systems, Prin		-					roject for		
	and tertiary packaging	*		fre	_	food		ackaging,		
	fresh and processed f	oods: packaging		coı	nsideri	ng		primary,		
	systems for fresh foods	s, challenges and		sec	condar	y,	and	tertiary	3,4	
	considerations, design project proposal				ckagin	_	needs			
	fresh food packaging, sh	elf-life extension			corpora	_		_		
	techniques.				elf-life			extension		
137	Custoinable Dealers'		-	_	hnique		1. 1	4		
IV	Sustainable Packaging Trends and advancement	ata in avatainahla	6							
	packaging, role and bene							and astainable	3,4	
	intelligent packaging, ap							the role	3,4	
	preservation and safety.	r		_	_	-	_	tive and		
	F		all.				una	I		

			intelligent packaging technologies in enhancing food preservation and safety.	
V	Packaging Regulations and Safety: regulatory requirements for food packaging, food safety considerations in packaging design, packaging innovations and future trends, emerging technologies and future trends in food packaging.	6	Students will be able to explain regulatory requirements for food packaging and integrate food safety considerations into the design and development of packaging solutions, while also discussing emerging technologies and future trends shaping the field.	4,5

# **Reference Books:**

R1. Ross et al; Modern Nutrition in Health and Disease; 8th edition; Lea & Febiger, U.S; 1993

R2. Battle; "Essentials of Public Health Biology: A Guide for the Study of Pathophysiology; 1st edition; Jones and Bartlett Publishers, Inc; 2008.

# OTHER LEARNING RESOURCES:

Coursera, YouTube

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Discuss the importance, functions, needs and role of food packaging.	1,2,3							
2	Explain the role of different types of packaging materials.	1,2,3							
3	Describe various food packaging systems and process different forms of packaging.	1,2,3							
4	Describe various food packaging systems for fresh and process food groups.	1,2,3							
5	Describe the advancements in the field of packaging.	1,2,3							



# **Assam down town University**

# Curriculum and Syllabus

# Bachelor of Science in Microbiology

OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.1

# **FACULTY OF SCIENCE**

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured the

course curriculum as per the guidelines of National Education Policy 2020. This document contains

outline of teaching and learning framework and complete detailing of the courses. This document is

a guidebook for the students to choose desired courses for completing the programme and to be

eligible for the degree. This volume also includes the prescribed literature, study materials, texts,

and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated 16th

& 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Downey

Member Secretary, Academic Council

# Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

# **Missions**

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving societybetter.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

# **Programme Details**

### **Programme Overview**

Bachelor of Science in Microbiology is a 3-year undergraduate Programme which deals with fundamental and advanced study of the microorganisms, including microbial cellular processes, their harmful and beneficial aspects, microbes for human welfare, molecular details of microbial cells and develops knowledge and understanding for applying it for societal benefits which may include sectors such as healthcare, agriculture, soil and environment, food processing, pharmaceutical etc. The objective of this Programme is to produce intellectual and proficient microbiologists by enhancing the abilities and skills of students for application of microbiology theories and expertise in the live problems faced by the industry.

# I. Specific Features of the Curriculum

Gaining proficiency in microbiology involves mastering both theoretical concepts and practical applications. This includes understanding how microorganisms cause infectious diseases and learning their diagnostic methods. It also involves exploring the beneficial roles of microorganisms in environmental, agricultural, and industrial sectors. Furthermore, expertise in molecular and immunological techniques is crucial. With this comprehensive knowledge, graduates are well-equipped to pursue entrepreneurial ventures in microbiology, utilizing their skills to innovate and lead in the field.

# II. Eligibility Criteria:

A minimum of 45% in 10+2 with Biology, Chemistry and English as compulsory subjects from a recognized board.5% relaxation for SC/ST, EWS and specially abled candidates.

# III. Program Educational Objectives (PEOs):

**PEO-1:** AdtU Microbiology Graduates will be prepared for successful careers in applied fields of microbiology in both government and private sectors and as entrepreneurs.

**PEO-2:** Microbiology Graduates will possess expertise in core microbiology areas as well as interdisciplinary fields for significant contributions to the service of humankind.

**PEO-3:** Graduates will be successful in higher education and research in areas of microbiology if pursued.

# **IV. Program Specific Outcomes (PSOs):**

**PSO1:** Holistic Development: Exhibit interpersonal ability and adaptability in diverse sociocultural societies for efficient working in the profession through life-skill learning, and co-curricular and extracurricular activities.

**PSO2: Global Certification:** Demonstrate competency in the profession by attaining global certification offered by international universities of repute.

**PSO3: Techno-Professional Proficiency:** Apply the knowledge of interdisciplinary microbiological approaches with industrial applications to become competent professionals.

# V. Program Outcome (PO):

**PO1: Microbiological Knowledge**: Apply the knowledge of basic sciences, fundamentals of microbiology and applied biological sciences to address issues related to agriculture, healthcare, industry and the environment.

**PO2**: **Problem Analysis:** Critically analyze microbiological problems in interdisciplinary aspects to resolve associated challenges with rational solutions.

**PO3: Modern Techniques Usage:** Apply standardized methods, contemporary analytical techniques and tools to conduct experiments and systematic analyses.

**PO4**: **Environmental Sustainability:** Assess the impacts of provided solutions on the environment, and redesign it for better sustainability.

**PO5:** Communication: Communicate scientific information effectively across diverse audiences, and prepare documents, reports, presentations etc.

**PO6: Ethics and Values:** Apply universal human values, and follow ethical principles and scientific norms in the profession.

**PO7:** Individual and Teamwork: Perform efficiently as an individual, and as a member/leader in a team of diverse professionals, and in multidisciplinary settings.

**PO8:** Continual Learning: Engage in continuous learning, fostering advances in scientific knowledge and technology

### VI. Total Credits to be Earned: 133

# VII. Career Prospects:

Graduates with a B. Sc. in Microbiology can pursue a Master's degree in Microbiology or embark on diverse career paths. They can work as research scholars in research and development laboratories, serve as microbiologists in hospital laboratories, and take on roles as microbiologists or quality control officers in food processing industries. Opportunities also exist in beverage and pharmaceutical industries, biotechnological firms, and various agricultural and environmental organizations, allowing them to apply their expertise in a wide range of professional settings.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the Programme shall be added to the score of the end-semester examination.

# A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

S.N.	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination) *	30
2.	In-Sem Exam – II (ISE-II) (Written Examination) *	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

**Note:** Total Internal assessment should be out of 40

# **INSTRUCTION**

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

# **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

### I. Pre-Examination:

# Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

# III. Pattern of Question Papers:

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl. No.	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

# IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

# V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

# VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.

- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

# VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

# C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

# i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a

single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

# ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

# iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade **Grade Points Description** 10 Outstanding 0 9 A+Excellent A 8 Very Good 7 B+Good В 6 Above Average C 5 Average P 4 Pass F 0 Fail Abs 0 Absent

0

**Table 2: Letter Grades and Grade Points** 

# iv. Grade Point Average:

**UFM** 

# a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the

Unfair Means

Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

# b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

### **D.** Post-Examination

# i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

# INSTRUCTION TO TEACHERS AND STUDENTS

# (Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

# 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyse, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more

time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.

d. Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

# The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of	
Teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

# Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

# SEMESTER WISE COURSE DISTRIBUTION

	Sl.			G	Е	'ng	gaş	gei	me	nt		Maxii	num N	Aarks	
	No	C C- 1-	C T'41.	Course		_		_					for		
		Course Code	Course Title	Category	L	T	P	S	R	О	C	IA*	SEE *	PE*	Total
	1	24BSMB1101	Introduction to	DCC Maion	2	^	2	_	0	0	4	60	40	100	200
	1.	R	Microbiology	DSC -Major	3	U	2	U	0	0	4	60	40	100	200
	2.	24BSZO1101	Animal Science	DSC- Minor	2	0	2	0	0	0	3	60	40	100	200
		R				_		Ľ	Ľ						
ter I	3.	24BSCH1101 R	Basic Chemistry	DSC- Minor	2	0	2	0	0	0	3	60	40	100	200
Semester I	4.	24BSMB1102 R	Microbiology for Human Welfare	DSC- Minor	2	0	0	0	0	0	2	60	40	0	100
	5.	24UBFS1101 R	Basic of Statistics	MDC	3	0	0	0	0	0	3	60	40	0	100
	6.	24UBPD1102 R	Elementary English (CLPPD)	AEC	0	0	4	0	0	0	2	0	0	100	100
	7.	24BSAG1001 R	Agricultural Education	VAC	2	0	0	0	0	0	2	60	40	0	100
	8.	24UBEC1101	Extra-Curricular Activities	Co and extra- Curricular	0	0	0	4	0	0	1	0	0	100	100
	Total							l	<u> </u>		20				1100
	Sl.				Engagement					nt		Maxi	mum N	mum Marks	
	No	Course Code	Course Title	Course			3a	gc.	1110	/11t			for	ı	
				Category	L	T	P	s	R	О	C	IA*	SEE *	PE*	Total
		24BSMB1201	Cell Biology and												
	1.	R	Microbial Physiology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSMB1202	Human Disease Biology	DSC- Minor	2	0	2	0	0	0	3	60	40	100	200
	۷٠	R	Tullian Disease Blology	DSC- WITHOU		U		Ů	U	0		00	40	100	200
	3.	24BSFS1201	Forensic Biology	DSC- Minor	2	0	0	0	$ _{0}$	0	2	60	40	0	100
		R 24BSMB1203													
r II	4.	R	Biophysical Chemistry	DSC- Minor	2	0	2	0	0	0	3	60	40	100	200
Semester II	5.	24BSAG1002	Agricultural Heritage	MDC	1	0	Λ	0	0	0	1	60	40	0	100
Sen	٥.	R	Agricultural Heritage	MDC	1	U	U	U	U	U	1	00	40	U	100
	6.	24BAPS1206 R	Psychology of Happiness	MDC	2	0	0	0	0	0	2	60	40	0	100
	7.	24UBPD1202 R	Implicit English	AEC	0	0	4	0	0	0	2	0	0	100	100
	8.	24UBES1201	Environmental Education	VAC	2	0	0	0	0	0	2	60	40	0	100
		R	(Online)	,,,,,	_			Ĺ	Ĺ						
	9.	24UCDT1201 R	Ideation and Design Thinking	SEC	0	0	2	0	0	0	1	0	0	100	100
	10.	24UBCC1201	CO Curricular Activities	Co and extra- Curricular	0	0	0	4	0	0	1	0	0	100	100
							_			21				1300	

	Sl. No.	Course Code	Course Title	Course Category	E	ng	ga	ge	me	ent		Maxi	mum N for	/larks	
	110.			Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1.	24BSMB2101 R	Biomolecules	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSMB2102 R	MicrobialGenetics	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	3.	24BSZO2101 R	Entomology	DSC- Minor	3	0	0	0	0	0	3	60	40	0	100
	4.	24BSBO2101 R	Forestry	DSC- Minor	3	0	0	0	0	0	3	60	40	0	100
ır III	5.	24BSFD2101 R	Basics of Food Science	DSC- Minor	2	0	0	0	0	0	2	60	40	0	100
Semester III	6.	24BSCH2001 R	Natural Product Chemistry	MDC	2	0	0	0	0	0	2	60	40	0	100
S	7.		PDP English Courses	AEC	0	0	4	0	0	0	2	0	0	100	100
	8.	24BSMB2103 R	Mushroom Cultivation	SEC	0	0	4	0	0	0	2	0	0	100	100
	9.	24BSMB2104 R	Field Training	Field Training	0	0	0	4	0	0	1	0	0	100	100
												1100			
	Sl.			Course	Engageme			nt		Maximum Marks					
	No.	Course Code	Course Title	Category								for			
	110.			Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1.	24BSMB220 1R	Enzymes and metabolism	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSMB220 2R	Molecular Biology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
ter IV	3.	24BSMB220 3R	Bioinstrumentation	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
Semest	4.	24BSMB220 4R	Immunology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	5.		PDP English Courses	AEC	0	0	4	0	0	0	2	0	0	100	100
	6.		Aptititute Course	SEC	0	0	0	8	0	0	2	0	0	100	100
	7.	24UUHV220 1R	UHV	VAC	1	0	0	0	0	0	1	60	40	0	100
	8.		BLSS	VAC						0	1	0	0	100	100
			Financial Literacy	MDC	1	0	0	0	0	0	1	0	0	100	100
	Total 23 1300														

	Sl.	Sl. Course Code Course Title		Course	Е	ng	gaş	ge	me	ent		Maxii	mum N for	/larks	
	110.			Category	LTPSRO			С	IA*	SEE*	PE*	Total			
	1.	24BSMB310 1R	Soil and Agricultural Microbiology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSMB310 2R	Bioinformatics	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
er V	3.	24BSMB310 3R	Tissue Culture	DSC -Major	4	0	0	0	0	0	4	60	40	0	100
Semester V	4.	24BSMB310 4R	RDT	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	5.	24BSMB310 5R	Biofertilizer Production	SEC	0	0	4	0	0	0	2	0	0	100	100
	6.		Logical Resonaing Course	SEC	0	0	0	8	0	0	2	0	0	100	100
	7.	24BSMB310 6R	Summer Internship	Internship	0	0	0	0	0	24	4	0	0	100	100
	8.	24BSMB310 7R	Mini Research-R1	Research	0	0	0	0	12	0	2	0	0	100	100
	Total									26				1100	
	Sl. No.	Course Code	Course Title	Course		Engagement			ent		Maxii	mum Marks for			
	INO.		Course True	Category	L	T	P	S	R	О	C	IA*	SEE*	PE*	Total
	1.	24BSMB320 1R	Research Methodology	DSC -Major	4	0	0	0	0	0	4	60	40	0	100
ter VI	2.	24BSMB320 2R	Food and Dairy Microbiology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
Semester VI	3.	24BSMB320 3R	Medical Bacteriology and Virology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	4.	24BSMB320 4R	Medical Mycology and Parasitology	DSC -Major	3	0	2	0	0	0	4	60	40	100	200
	5.	24BSMB320 5R	Mini Research-R2	Research	0	0	0	0	24	0	4	0	0	100	100
	Total 2							20				800			

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEMESTE	:R – I												
Cours	se Title		Introduct		icrobi	ology										
Course	se Code	24BSMB111R	Total credits: 5		L		P	S	R	(	O/F	C				
Cours	se Coue	24DSWIDITIK	Total hours: 45T-	+60P	3	0 4	4	0	0		0	5				
Pre-re	equisite	Nil Co-requisite Nil														
Progr	amme		Bachelor of S	of Science in Microbiology												
Semes	ster	Fall/ I semester of first year of the Programme														
Course Objectives		microbiology a 2. To teach the stu 3. The course	<ol> <li>The objective of this paper is to familiarize the students with the basic concepts of microbiology and diversity of microorganisms.</li> <li>To teach the students about the different staining techniques of microorganisms.</li> <li>The course provides insights concerning aspects of different types of microorganisms, culturing and staining of microorganisms.</li> </ol>													
	C <b>O</b> 1		crobial classification	n and co	ontribut	tions o	of ke	y r	nicro	bio	logis	ts in				
		development of m	icrobiology. acteristic of bacteria	مسط بینسیم	. and th	im *		hah	tota							
	CO2 CO3		ent culture media an						ıtatS							
	CO4		cteriological stainin					<b>311.</b>								
(	CO5	Explain the mecha	nnism of antimicrobi	al compo	ounds a	nd thei	ir pro	duc	tion.							
Unit No.		Content		Contac Hour	t	Learning Outcome						KL				
	Edward Microbic Microbic kingdom Morpho Bacteria	rani, Pasteur, Joseph Jenner and Fleming ology; ial Classification: to and five kingdom logy of bacteria, Ult I cell, Nutritional ty asis of oxygen requi	wo kingdom, three classification; trastructure of pes, classification		Describe, illustrate a explain history of microbiology and classification of microorganisms, the morphology, cell struand nutrition of bacters.				tructu							
II	Thermop psychrop halophil General lytic and	es in different environte philes, hyperthermo philes, acidophiles, es, Barophiles, Methoda characteristics and all lysogenic cycle. Ut fungal cells.	philes, alkaliphiles, hanogens structure of virus,	13	exp extr Und and	scribe, lain di remoph derstan replic terioph	fferential files.  Indicated the ation	nt ty stru	pes o			1,2				
III	Methods types - F	media and types: Cus, Concept of Sterili Physical and chemic ol coefficient of disi	7	Describe, illustrate and explain the different ty of culture media and Preservation Methods microorganisms and the different methods of sterilization.				nt typ nd ods of d the	f		1,2					
IV	auxochrof staini	nd Staining Techniq ome, chromophores ng - Gram, Acid Fa and Endospore.	and dyes. Types	7	exp	Describe, illustrate and explain the different staining techniques.						explain the different				1,2
V		ics and types: Antibganisms, Antifungal		3	diff	scribe a erent t	ypes		in the	e		1,2				

	1. The components, use and care of bright	60	Describe, illustrate and	1,2,3,4
	field microscope, and various		explain and apply staining	
	microbiological instruments.		techniques and carry out	
	2. Enumeration (counting) of bacteria by		microscopic examination.	
	plate count or serial dilution – Agar Plate			
	Technique.			
_	3. Counting of bacterial population by the use			
ca	of spectrophotometer.			
Practical	4. Preparation of bacterial smear and staining			
Pra	(Simple, Grams, Negative and Acid fast).			
	5. Preparation of culture media and isolation			
	of pure culture – serial dilution, pour plates			
	technique, spread plate technique, types of			
	streaking.			
	6. Fungal staining: KOH mounting, LPCB.			
	7. Study of temperature and PH sensitivity of			
	microbes.			

# **TEXT BOOKS:**

- 1. Text book of Microbiology by Prescott, Harley, and Klein's
- 2. Text Book of Microbiology by PC Trivedi, S Pandey & S Bhadauria
- 3. Textbook of Microbiology by Ananthnarayanan and Panicker

### **REFERENCE BOOKS:**

- 1. Microbiology A systems Approach by Cowan and Talaro
- 2. Experiments in Microbiology, Plant Pathology and Biotechnology by K.R. Aneja

# **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping				
S.N.	Course Outcome (CO)	Mapped Program Outcome			
1	Describe the microbial classification and contributions of key microbiologists in development of microbiology.	1,2,3,8			
2	Describe the characteristic of bacteria and virus and their various habitats	1,2,8			
3	Explore the different culture media and the concepts of sterilization.	1,2,3,8			
4	Apply different bacteriological staining techniques for viewing.	1,2,3,8			
5	Explain the mechanism of antimicrobial compounds and their production.	1,2,8			

	SEMESTER – I										
Cours	Course Title Microbial Physiology  Total credits: 4 L T P S R O						T 6 =	T =			
Cours	se Code	24BSMB112R	Total credits: 4 Total hours: 45T+24P			T 0	P 2	S 0	R	O/F 0	<u>C</u>
Pre-r	eanisite	Nil	Co-requisite				L	_	_	0	4
	Pre-requisite Nil Co-requisite Nil Programme Bachelor of Science in Microbiology										
Seme			Fall/ I semester of				mm	e			
		1.To build a stroi	1. To build a strong foundation in the dynamics and bioenergetics of biochemical								
l .	ourse	pathways									
Obj	ectives	2. To teach the concept of transportation of biomolecules and metabolism of									
		carbohydrates.  3. To teach about the molecular adaptation of bacteria									
	C <b>O</b> 1					nt of	f boo	torio	1 000	xyth	
	.01		encing bacterial gro								
(	CO2	Determine the mo		cules in m	icrobes, a	ınaly	yze	the c	quoru	m sen	ısıng
		properties and biof			1	1 1.			.1		
	CO3		aerobic and anaerob	•				_	athw	ays	
	CO4	Illustrate the princi				nıcro	obes	•			
	CO5	Describe microbial	nitrogen fixation ar								
Unit		Content		Contact	Lear	ning	g Oı	ıtcor	ne	K	L
No.	Microbia	al Growth and Nutrit	ion Microbial	Hour 10	Describe	2000	l avı	alain	the	1	,2
1		Definition of growth		10	mode of						,∠
			Influence of environmental and m						o <b>1</b> 11		
		n growth, generation			influence	e of	diff	erent			
		ate. Synchronous gro		factors o	n th	eir g	growi	th			
		chemostat and turbic									
		Measurement of Gro									
		opic count - Haemoc Iembrane filtration; I									
		g method; Measurem									
		y measurements- Ne									
		hotometer technique	s. Growth Yield								
	,	on of terms)									
		al Nutrition: Microbi									
		onutrients, classifica nutritional requirem	<u> </u>								
		t: Structure and orga									
		al membranes, Types									
transport - passive, facili											
transloca		ation, membrane bou	*								
	transport system, carrier models, liposomes,										
	ion channels, Na+ K+ -ATPase.										
II		Movement of biomolecules: Facilitated 8 Describe, illustrate and				1	,2				
		, aquaporins, mecha			explain i						
driven tr uniport), Phospho		, ABC transporters,			biomole						
		ansport (symport, an Group translocation	•		diffusion driven tr				otic		
		transferase system (I			phospho				vsten	,	
		am +Ve and Gram -V			Phospho	J. W11	J1 <b>V</b> 10	·	, 50011	-	
,		ent of whole cell: Che									
		and regulation of bio	film formation								

III	Carbohydrate metabolism: Glucose catabolism (Embden-Meyerhof pathway (EMP) /glycolytic pathways, Entner-Doudoroff pathway and Pentose phosphate pathway (PPP) /hexose monophosphate shunt) and Glucose anabolism (Gluconeogenesis). Pyruvate decarboxylation. Pyruvate utilization pathways (TCA cycle, glyoxylate cycle). Fermentation pathways: Yeast fermentation, Fermentation to produce short-chain fatty acids and mixed acid types	10	Describe, illustrate and explain the concepts of carbohydrate metabolism and mechanism of the pathways.	1,2
IV	Principles and components of photosynthesis (light absorption, light driven electron flow). Carbon dioxide fixation pathways (dark reaction). Photophosphorylation (cyclic and non-cyclic (z-scheme)). Generation of reducing power. Oxygenic and non-oxygenic photosynthesis. Oxidative phosphorylation (PMF and Electron Transport System). Chemiosmotic theory of ATP synthesis	8	Describe, illustrate and explain the principles and components of photosynthesis and carbon dioxide pathways	1,2
V	Nitrogen metabolism: Biological nitrogen fixation, Component of Nitrogenase system, Inorganic nitrogen metabolism (denitrification and nitrification), Assimilation of inorganic nitrogen (ammonia), Molecular adaptations in microbes for nitrogen fixation (free living aerobic, free living anaerobic and symbiotic microbes). General reactions of amino acids and the Stickland Reaction.	9	Describe and explain the basic knowledge on the metabolism of nitrogen fixation and components of nitrogenase system	1,2
Practical	<ol> <li>Microscopic count of bacteria.</li> <li>To determine the growth curve of bacteria.</li> <li>Measurement of turbidity</li> </ol>	30	Describe, illustrate and explain and apply microscopic count and growth curve of bacteria	1,2,3,4

# **TEXT BOOKS:**

- 1. The Microbial world by Stanier, Ingraham, Wheelis and Painter. Mc Millan Ltd., London.
- 2. Microbial Physiology by Moat, Foster and Spector, Wiley.
- 3. Essentials of Bacterial Physiology by Umbreit.
- 4. Bacterial Physiology and Metabolism by Skokatch.
- 5. Microbial life in Extreme Environments by Kushner, D.J. Academic Press.
- 6. Cell Biology by Powar, C.B.
- 7. The control of Antibiotic Resistance in Bacteria by Harris C.H.S, Harris DM.
- 8. Biochemistry of Antimicrobial Action by Franklin and Snow, Chapman and Hall, New York

# **REFERENCE BOOKS:**

- 1. Microbiology Including Immunology and Molecular Genetics. III Ed. By Davis.. Dulbecco, Eisen and Ginsberg.
- 2. Medical Laboratory Manual for Tropical Countries. Vol. II by Cheesbrough, M.
- 3. Essentials of Clinical Immunology 7th Edition by Misbah S.A., Spickett G.P., Dalm V.A.S.H. Wiley-Blackwell (2006).
- 4. Immunobiology: The Immune System in Health and Disease, 6th Revised edition by Charles A. Janeway, Paul Travers, Mark Walport and Mark J. Shlomchik, Churchill Livingstone; (2004)

# **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Assess factors influencing bacterial growth and measurement of bacterial growth.	1,2,3,4,8				
2	Determine the movement of biomolecules in microbes, analyse the quorum sensing properties and biofilm formation.	1,2,3,4,8				
3	Describe different aerobic and anaerobic carbohydrate metabolism and pathways	1,2,3,8				
4	Illustrate the principles and pathways of photosynthesis in microbes.	1,2,3,4,8				
5	Describe microbial nitrogen fixation and adaptation.	1,2,3,4,8				

			SEMESTE	R – I							
Cour	Course Title Bio-Molecules										
Course Code		24BSMB113R	Total credits: 4 Total hours: 45T+	30P	1 3	T 0	P 2	S 0	R	0/F 0	C 4
Pre-r	equisite	Nil	Co-requisite				_	Nil			
Prog	ramme	Bachelor of Science in Microbiology									
Semester Fall/ I semester of first year of the Programme											
Course Objectives		<ol> <li>Understand the structural components and bonding mechanisms of nucleic acids.</li> <li>Comprehend the classification, properties, and significance of amino acids.</li> <li>Analyze the classification, structure, and functions of proteins.</li> <li>Examine the classification, properties, and biological roles of carbohydrates and lipids.</li> </ol>									
(	C <b>O</b> 1	Describe the struc	cture, functions and ty	ypes of	DNA	A and R	NA				
(	C <b>O2</b>	Outline the prope	rties of essential and	non-ess	sentia	al amino	o acid	•			
(	C <b>O3</b>	Describe various	structure of proteins	and cla	ssific	ation.					
	CO4	the laboratory qua	of carbohydrate in to alitative tests in their gorize lipids and their	analysi	S.		e, class	sificat	ion, p	roperti	es and
Unit	C <b>O</b> 5	Conten		Cont							KL
No.		Conten	•	Hou		Learning Outo			COIIIC		KL
I	ribose, nucleo bondin letter c forms   denatu	cleic acid: Structure (Nitrogenous bases, ose, deoxyribose, Nucleosides, cleotides); glycoside and phosphodiester ading, polynucleotide (formation, single ter code), DNA (Watson-Crick Model; ms [A, B, Z]; Physical Properties; naturation and renaturation); RNA and its bes; Clover leaf model of t RNA.				Descrii explair function includit forms.	n the son of n	tructu ucleic	re and		1,2
II	Non- E	o acids: Classifications; Essential and Essential amino acids; Properties ical, chemical & optical); Importance.				Describe explain proper and cla	n the s ties of	tructu `amin	re and		1,2
Protein: Classification based or [fibrous proteins (keratins, colla elastin), globular proteins (hem myoglobin), lipoproteins, metal glycoprotein and nucleoprotein composition); Structure (primar tertiary & quaternary); Denatur renaturation; Functions.		collagen and (hemoglobin, metallo proteins, oteins]; chemical rimary, secondary,	10		Describe explain function	the s	tructu	re and	1	1,2	
and L rotation Disaction proper (occur function types,		Carbohydrates: Classification; Isomerism, (D and L forms); Anomers, Epimers, Mutarotation; Monosaccharides (linear and cyclic). Disaccharides (structure, occurrence, properties and functions); Cellulose (occurrence, structure, properties and functions); Heteropolysacchrides (occurrence, types, composition and function), Homopolysaccharides.		10		Descril explain function	the s	tructu	re and		1,2
V	Lipids:	fatty acids; glycero cations; and charact fication and iodine	terization;	10		Descri explair function	the s	tructu		d	1,2

	(glycerol, fats and oils); Properties and function (Phospholipids and Prostaglandins); Structure (sterols, Bile acids, steroid hormones, plant sterol, ergo sterol, stigma sterol, cholesterol, glucocorticoid, mineralocorticoids); Lipoproteins (classification, composition and importance); Role of Lipids in cellular architecture and functions.	20		1224
Practical	Qualitative analysis of Carbohydrate Fehling's Test Barfoed's Test Molisch's Test Benedict's test Qualitative analysis of proteins Biuret Test Xanthoproteic Test Precipitation test Heat and Acetic acid test Qualitative analysis of amino acids Ninhydrin Test	30	Describe, illustrate and explain apply qualitative analysis of carbohydrate, protein and amino acids.	1,2,3,4

# **TEXT BOOKS:**

1. U Satyanarayana. Biochemistry. 13th edition. Elsevier Health Sciences; 2017.

# **REFERENCE BOOKS:**

- R1. David L. Nelson, Michael Cox. Lehninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R2. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.
- R3. Voet and Voet. Biochemistry. 3rd edition. John Wiley & Sons, 2004.

# **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Describe the structure, functions and types of DNA and RNA	1,2,3,8				
2	Outline the properties of essential and non-essential amino acid.	1,2,3,8				
3	Describe various structure of proteins and classification.	1,2,3,8				
4	Outline the basics of carbohydrate in terms of its structure, classification, properties and the laboratory qualitative tests in their analysis.	1,2,3,8				
5	Identify and categorize lipids and their derivatives.	1,2,3,8				

	SEMESTER – I														
Cou	rse Title				imal So	cie									
Con	rse code	24FSZO101R	Total cre			Ĺ	T	P	S	R	0/	_	C		
			Total hou		2	2	0	0	0	0	0		2		
	requisite	Nil		requisite	· N/	•			N	il					
_	gramme	Fal		or of Science											
Sem	ester	1. Analyze the di		ter of first							1 Izin	ada	.m		
		focusing on trip	•					1 01	ше а	IIIIIIa	I KIII	guc	)111 <b>,</b>		
					•			latio		. anati	0.44		1		
	Course	2. Understand life processes including osmoregulation, excretion, neu conduction, endocrine regulation, and reproduction.							IIai						
(	Objectives	· ·	_		•				1		1	1			
	ū	3. Examine the		_		cts	anc	l mı	crobe	es, ai	na e	xpı	ore		
		integrated pest	_	_											
		4. Explore the pr							d ger	ietics,	, inc	lud	ıng		
		Mendelian and			•		erns	•							
	CO1	Identify and classif	_												
	CO2	Explain various bio													
	CO3	Explain and illustra													
	CO4	Illustrate the evolut				ıod	ıver	sity l	otsp	ot					
Unit	CO5	Describe classical g  Content	genetics of	Contact		00	pni-	α Λ	utcor	ne		I/	L		
No.		Content		Hour	_	æa.	1 1111	ig O	utcor	пе		17	L		
I	Diversity of	Animal Kingdom:		5	Descr	ibe	ilh:	ıstra	te and	1		1	,2		
		coelomate organizati	on:		explai								,—		
		h mantle: Phylum Mol		associated with each system					ı						
		h enterocoel: Phylum		of the	bo	dy i	n ve	rtebra	ites						
		ata, Phylum Hemichor		and in	ive	rteb	rates	•							
		rdata, Subphylum		Identi	•										
		, Subphylum Cephalo		place					ms to	)					
		Vertebrata, Super class		perfor											
		ass Cyclostomata, Sup			accord habita										
		ata, Class Pisces (Cart h), Class Amphibia, C			паона	us (	or u	ie an	iiiiais	•					
		ss Aves, Class Mamm													
II		es Concepts of osmore		6	Descr	ibe	, illi	ıstra	te and	1		1	,2		
		n, Categorization of a			explai								,—		
	the basis of p	orinciple nitrogenous	excretory		differe				_						
		nithine cycle, formation			endoc	rin	e re	gulat	ion a	nd					
		ination and detoxifica			reproc		tive	biol	ogy o	of					
		Coordination, Irritabil	-		anima	ıl.									
		neuron, sense organs													
		Conduction of nerve i	•												
		ntial, action potential riod. Synaptic transm													
		gulation: Hormones a													
		ssengers, feedback	Б												
		Reproduction:													
		sis, structures of egg a	ınd												
	sperm of ma														
		ntion, oviparity, vivipa													
	ovo-viviparit														
III		biology: Mutualistic		5	Descr							1	,2		
		between insects and n			explai										
		on and the importance			associ										
		angal symbioses: Ant termites Microorganis			behav as a v					insect					
		ior. Insects as Vectors			diseas			ı val	10u8						
L	I III JOE JOHAY	11150015 45 7 001015	J.	l	and cub	. <del></del> .					1				

	Animal pathogens; Integrated pest			
IV	management for vector control  Evolution and Biodiversity: Evolution, Origin of life: Emergence of life on primitive earth, Evolution and adaptations: Microevolution, Role of Natural Selection in microevolution, Co-evolution. Ecological niches and adaptations. Biodiversity, Definition, Biodiversity hotspots, Benefits of Biodiversity, Biodiversity conservation, Bio- wealth of India. Human activities affecting biodiversity. Future of evolution.	7	Describe, illustrate and explain the evolution and diversity.	1,2
V	Genetics: Gene and gene concepts, Mendelian inheritance: Monohybrid and dihybrid cross, Concept of dominance. Exception to Mendelian inheritance: incomplete dominance, co- dominance; Interaction of genes: (Epistasis: recessive, dominant, double recessive and double dominant epistasis), lethal genes, Cytoplasmic inheritance: Kappa particles in Paramecium, sigma factor in Drosophila and shell coiling in Limnea. Introduction to human genetics: Mendelian phenotypic traits in humans: Dominant, recessive and X- linked characters (2 examples each), Pedigree analysis: Dominant, recessive and X- linked traits, Genetic counselling, Risk of inheriting a disease from consanguineous marriage.		Describe, illustrate and explain the classical genetics and learn about diseases associated with genetic disorder	1,2

- 1. Principles of Genetics by Snustad and Simmons (7th Edition) John Wiley and Sons, USA.
- 2. Textbook of physiology by Dr. A. K. Jain. (9th Edition). APS books.
- 3. Edward O. Wilson, 1996, Biodiversity, 521 pp., National Academy Press.
- 4. Alison J. Stattersfield, Michael J. Crosby, Adrian J. Long, and David C. Wege. 1998. Endemic Bird Areas of the World: Priorities for Biodiversity Conservation. 846pp.
- 5. Maule, A.G. and Dr. N.J. Marks Parasitic Flatworms, Molecular Biology, Biochemistry, Immunlogy, Physiology.

#### **REFERENCE BOOKS:**

- 1. Romer, A.S. Vertebrate Body.
- 2. Majupuria, T.S. Introduction to Chordates.
- 3. Hartl D. L. and A. G. Clark (1989 & 1997): Principles of Population Genetics. Sinauer
- 4. Ridley M. (1993): Evolution. Blackwell.
- 5. Microbiology: an Introduction by Tortora, G.J., Funke, B.R. and Case, C.L., 944 pp.

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Identify and classify species of animal kingdom.	1,2,8						
2	Explain various biochemical processes occurring in living being	1,2,8						
3	Explain and illustrate phenomena of animal reproductive biology	1,2,8						
4	Illustrate the evolution process, importance of biodiversity hotspot	1,2,8						
5	Describe classical genetics of living organism	1,2,8						

			SEM	IESTER –	I							
Cours	se Title			В	asic Che	mist	ry					
Cours	se code	24FSCH101R	Total C	redits: 2	]	[ ]	T	P	S	R	O/F	С
Cours	se coue	24FSCIII0IK	Total H	ours: 30T	:	2	0	0	0	0	0	2
Pre-re	equisite	Nil	Co	o-requisite					N	il		
Progr	amme		Bachelor of Science in Microbiology									
Semes	ster	F	all/ I seme	ester of fir	st year o	f the	Pr	ogra	amme	!		
	Course ojectives	<ol> <li>To give the kno</li> <li>To give a detail and the knowled</li> <li>To give the kno</li> </ol>	ed descrip	otion of ato	mic struc Juantum	cture chem	, dit nisti	ffere ry.	nt the	ories		to it
	CO1	Identify the order temperature dependent	dency of r	reaction rate	es using	the A	Arrh	eniu	s equa	ation.		
	CO2	Describe concepts buffers and solubil		trochemistr	ry, electi	oche	emi	cal	cells,	acid	s/base,	pH,
CO3  Describe and analyze atomic structur Quantum mechanics and Schrodinger wave								rg I	Uncer	tainty	princ	iple,
	CO4	Describe concepts	Describe concepts of chemical bonding, periodic properties.									
	CO5	Describe the diffe Organic molecules				ons a	alor	ng w	ith th	eir m	nechani	sms.
Unit No.		Content		Contact Hour		Lear	rnir	ng O	utcon	ne		KL
I	molecula nth order	Kinetics: Order- rity. First and second rate equation, temper ace of rate of reactions	ature	5	To identify the order (0, 1 or 2) associated with each integrated rate law equation, to describe the "half-life" of a chemical reaction. Understand the temperature dependence of rate of reactions							1,2
II	conductar electrolys theory, A dissociati constants buffers, s	ilibrium: Electrolytic nce, Faraday's Law of sis, Electrolytes, Lewi rrhenius theory for on of electrolytes, ion of weak acids and ba olubility products, sal	s's nization ses, pH,	6	through Arrhenius equation.  Describe, illustrate and explain the underlying concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility							1,2
III	Atomic Structure: Recapitulation of Bohr's theory and its limitations, dual behavior of matter and radiation, DE Broglie's relation, Heisenberg Uncertainty principle. Need of a new approach to atomic structure. What is Quantum mechanics, Time independent Schrodinger equation and meaning of various terms in it. Wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. (Only graphical representation) Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability			Bohr's theory and its limitations, dual behavior of matter and radiation, DE Broglie's relation, Heisenberg Uncertainty principle. Need of a new approach to atomic structure. What is Quantum mechanics, Time independent Schrodinger equation and meaning of various terms in it. Wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. (Only graphical representation) Rules for filling electrons in various orbitals, electronic							erg m rave	1,2

	of half-filled and completely filled orbitals, concept of exchange energy.			
IV	Chemical bonding- Various theories, covalent, hydrogen Bonding. Effective nuclear charge, atomic and ionic sizes. 6 Ionization energies, electron affinity and electronegativity, hard soft acids and bases.	7	Describe, illustrate and explain the concepts of chemical bonding by using various theories, periodic properties like Atomic and Ionic size Ionization Energy Electron Affinity, Electronegativity of elements of periodic table.	1,2
V	Organic Reactions and Stereochemistry: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule, Representations of 3 dimensional structures, structural isomers and stereo isomers. Configurations and symmetry and chirality, enantiomers, disastereomers, optical activity, absolute configurations and conformational analysis.	7	Describe, illustrate and explain the different types of organic reactions along with their mechanisms. How to design syntheses of organic molecules. Acquire the knowledge of stereochemistry of organic molecules.	1,2

- 1. L. Eliel: Stereochemistry of Carbon Compounds, Tata Mc Graw Hill
- 2. Organic chemistry: structure and function by P. Volhardt and N. Schore.
- 3. Essentials of Physical Chemistry, Arun Bahl., B.S. Bahl., G.D. Tuli.
- 4. Concise Inorganic Chemistry, J.D. Lee.

### **REFERENCE BOOKS:**

- 1. T. W. Graham Solomon's: Organic Chemistry, John Wiley and Sons.
- 2. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.
- 3. E. L. Eliel: Stereochemistry of Carbon Compounds, Tata Mc Graw Hill.

### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Identify the order of the rate law equation, then characterize the "half-life" and temperature dependency of reaction rates using the Arrhenius equation.	1,2,3,8						
2	Describe concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility	1,2,3,8						
3	Describe and analyse atomic structure, Heisenberg Uncertainty principle, Quantum mechanics and Schrodinger wave equation	1,2,3,8						
4	Describe concepts of chemical bonding, periodic properties.	1,2,3,8						
5	Describe the different types of organic reactions along with their mechanisms. Organic molecules and their stereochemistry.	1,2,3,8						

			SEMEST	TER – I										
Cours	se Title		Ele	mentary E	nglish									
Cours	se code	24UBPD111R	Total Credits:		L	T	P	S	R	O/F	C			
			Total Hours:		0	0	2	O	0	0	2			
	equisite	Nil	Co-requ					Nil						
	amme			or of Science in Microbiology										
Seme	ster	Fall/ I semester of first year of the Programme												
	Course ojectives	y and use p negative se ar concepts tences, and nable stude l stress, and n skills: s, formal an cation. s: Enable s	ntences. Enable understa ents to int effective Enable d inform	e stu nd de crodu ely as stud al co	dentegre ace the sk and ents	es to es of hems nd of to unica	use comp selves fer in und ation,	detern parison s, use of format lerstand and id	niners, n. correct tion. d the lentify					
	CO1	Equip students to and to create both				h, ar	ticle	s, an	d aux	kiliary	verbs,			
	CO2	Teach students comprehend degree			m differ	ent	type	es o	f ser	ntences	, and			
	CO3	Prepare students intonation, and str	•						•	ronunc	iation,			
	CO4	Help students grasp the communication process, differentiate between communication types, manage both formal and informal communication, and identify barriers to effective communication.												
	CO5	Teach students the key components of an effective presentation and how to use visual aids proficiently.												
Unit No.		Content		Contact Hour				utco			KL			
I	i. Parts of ii. Article iii. Auxilia	S		6	Studen fundam of gran	enta	l un	derst			1,2, 3			
II	i. Determi ii. Sentendiii. Types Impera	Grammar (Flipped classroom) i. Determiners ii. Sentence Construction iii. Types of Sentences (Assertive, Imperative, etc.) iv. Degree of Comparison			Studen gramm varied	atica	lly c	orre	ct and		,2, 3,4			
III	ii. Pronun	Skills ction and Greetings ctiation, Intonation, and offering inform		5	Studen introdu engage convers pronun	ce the in bases	ems asic ns w	elves	s and		1,2, 3			

IV	Communication Skills i. Introduction to Communication ii. Process and Types of Communication, iii. Formal and informal communication iv. Understanding Barriers to Communication	7	Students will effectively communicate in both formal and informal settings.	1,2, 3
V	Presentation Skills i. Introduction ii. Essential characteristics of a good presentation iii. Use of Visual Aids in Presentation	8	Students will deliver well- organized and visually supported presentations.	1,2

- 1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2. Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plover crest Press.
- 4. Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### **OTHER LEARNING RESOURCES:**

https://www.ef.com/wwen/english-resources/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Equip students to recognize and apply parts of speech, articles, and auxiliary verbs, and to create both affirmative and negative sentences.	5,8						
2	Teach students to apply determiners, form different types of sentences, and comprehend degrees of comparison.	5,8						
3	Prepare students to confidently introduce themselves, use proper pronunciation, intonation, and stress, and effectively ask for and provide information.	5,7,8						
4	Help students grasp the communication process, differentiate between communication types, manage both formal and informal communication, and identify barriers to effective communication.	5,6,7,8						
5	Teach students the key components of an effective presentation and how to use visual aids proficiently.	3,5,7,8						

			SEMESTER – I									
Course	e Title		Extra-Cur	ricular Ac	tiviti	es						
Course	e code	24UBEC111R	Total credits: 1 Total hours: 60		L 0	T 0	P 0	S 4		R 0	O/F 0	C 1
Pre-re	quisite	Nil	Co-requi		U	<u> </u>	l u		Vil	U	U	1
Progra			Bachelor of Sci		icrob	iolog	gy					
Semest	ter	Fall	/ I semester of fi	rst year of	the I	Prog	ramı	me				
	ourse ectives	<ol> <li>To ascertain physical and mental development of the students and select best performers for state, national and international level competition.</li> <li>To enhance and improve student's talents in the field of sports, yoga, music, dance, drama, etc. through AdtU club activities and workshops.</li> </ol>										
C	01	Enhance Leadership Sl activities.	kills-Students wi	ll develop	leade	rship	abi	lities	s th	irou	ıgh va	arious
CO	<b>D2</b>	Improve Social Interactothers.	tion-Students wil	l learn to i	intera	ct an	ıd bu	ild 1	rela	itioi	nships	with
CO	<b>O3</b>	Develop Personal Inte personal interests and h		es- Studer	nts w	ill e	xplo	re a	nd	de	velop	their
CO	<b>D4</b>	Strengthen Problem-So problems creatively and		tudents w	ill in	nprov	ve tl	neir	ab	ility	y to	solve
CO	05	Foster Cultural Awaren of different cultures.	ess- Students wi	ll gain a be	etter ı	ındeı	rstan	ding	gan	d a	pprec	iation
Unit No.		Content		Contact Hour	]	Lear	ning	Ou	tco	me		KL
I	Based particic curriculurive Swimm Tennis games Drama encouractiviti interestorgani the stu	60	spor curr thro stud phy lead crea The man kno wor prof self fost The cult incl lear stud inte skill pass beyon	rts, nricular ugh lents sical dersh tivit; y wi lager wled kshoo essidering se ac ural susivi ning, lents rests ls, ar sions	Il enl ment, ge the ps wornals fiden g perstivit awar ty, a , enc to po , dev de cu that	, and iviti development amv mance, gair rought rance was on a lies penes and li oura ursue elophtiva exte	d codes (y cleans) de code	ortooffe lubs paging aging agi	ered s, lity, nd cical aed th. ee	1,2		

# **REFERENCE BOOKS:**

- R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel
- R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

# **OTHER LEARNING RESOURCES:**

https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Enhance Leadership Skills-Students will develop leadership abilities through various activities.	6,7
2	Improve Social Interaction-Students will learn to interact and build relationships with others.	6,7
3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.	6,7
4	Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.	6,7
5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.	5,6,7

	SEMESTER – II												
Cours	se Title			Bioinstr	umenta	tion							
Cours	se code	24BSMB121R	Total credit		L 3	T	P	S 0	R	O/F	C		
Pre-re	equisite	Nil	Total hours	quisite	3	0	2	U Nil	0	0	4		
	ramme	1111		r of Science	in Mic	robio	าไกฮง		•				
Semes		Sn							Δ.				
Senies	<del></del>	_	_	emester of first year of the Programme pes, and applications of various microscopy technique									
	ourse ectives	<ul><li>2. Understand to chromatograph</li><li>3. Comprehend electrophoresis</li></ul>	chromatography.  3. Comprehend the principles and applications of centrifugation and gel electrophoresis.										
C	CO1	Describe the differ											
C	CO2	Develop proficienc	y in different	chromatogr	aphic te	chniq	ues.						
C	CO3	Explore different a	nalytical centr	rifugation ar	nd their	applio	cation	1S.					
C	CO4	Explore different a	nalytical centr	rifugation ar	nd their	applio	cation	1S.					
C	CO5	Interpret the princip	oles and appli	cations of sp	pectrosc	ору							
Unit		Content		Contact	I	earn	ing (	Outco	me	]	KL		
No.	Microsc	copy: types of micros	scones and	Hour 10	Descril	ne ill	ustra	te and	explai	n	1,2		
_		nciple, resolving po			Describe, illustrate and explain the applications of different								
		al aperture	· 		types o			•					
II	Classific Choice Column column chromat	tography: Introductication, Separation teof method. Chromatography: A chromatography, Patography. Thin layer tography, Paper chromatography, Paper chromatography.	chniques, dsorption rtition matography,	10	Describe, illustrate and explain the concept of chromatography and its types with its working principle that enables separation of a biomolecules from a mixture sample						1,2		
III	rotors, A	gation: Introduction Application of densit lytical centrifugation Centrifugation and ion	y gradient . Different	7	Describe the function the central along wand app	dame trifug vith i	ental l gation ts dif	knowl 1 techr	edge o nique		1,2		
IV	principl techniqu and Nor	ctrophoresis: Introdu e, types, application, ue: Southern blot, W thern blot	10	Describe the the gel technic workin applica learnin blotting		1,2							
V	applicat electrop Spectros	ohoresis – principle a ion - agarose gel horesis, SDS PAGE scopic techniques: In e and application of scopy		8	Describ the tech electro spectro workin applica	nniqu phore scopy g prii	e of esis as y in the contract of the contract	nd erms c	•	n	1,2		

Practical	Operation of molecules from given sample by 1. Paper chromatography 2. Column chromatography 3. Thin layer chromatography 4. Separation of DNA and protein	30	Describe, illustrate and explain the use various instruments for analysis	1,2,3,4
	molecules by gel electrophoresis			

- 1. Biophysical Chemistry: principle and technique by Upadhyay and Nath.
- 2. Spectroscopy: atomic and molecular by Gurdeep R. Chatawal and Sham K. Anand.

# **REFERENCE BOOKS:**

- 1. C.R. Cantor and P.R. Schimmel; Biophysical Chemistry (Vol. 2-3). W.H. Freeman, 1980.
- 2. T.E. Creighton; Protein Structure. I.R.E. Press, 1989.
- 3. T.G. Cooper; The Tools of Biochemistry. Wiley Intersciences, 1977.
- 4. D. Holme & H. Peck; Analytical Biochemistry. Longman, 1983.

### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the different microscopy principles and techniques.	1,2,3,5,8					
2	Develop proficiency in different chromatographic techniques.	1,2,3,5,8					
3	Explore different analytical centrifugation and their applications.	1,2,3,8					
4	Explore different analytical centrifugation and their applications.	1,2,3,8					
5	Interpret the principles and applications of spectroscopy	1,2,3,5,8					

		SEMEST	ER – II								
Cours	se Title	Environment		logy and	d M	icro	bial	Ecol	ogy		
Comm	~ d .	Total credit		L	T			S R		F	С
	se code	24BSMB122R Total hours:		3	0		2 (	0 0	0	)	4
	equisite		equisite .	3.5: 1				Nil			
	amme	Bachelor o									
Seme	ster	Spring/ II semeste									
	ourse ectives	Understand the role of microorgan     Recognize microorganisms as ind	icators of al	teration	of a	n e	cosys	tem.			
-	CO1	3. Understand microbial processes a Enumerate the microbial diversity an				enta	l pro	blem	S		
-	02	Illustrate the occurrence and distribu				n th	e aqı	ıatic e	enviro	onn	nent.
	O3	Describe the role of microorganisms		_							
-		Explain the role of microorganism									ıt and
C	O4	Bioremediation.									una
C	O5	Describe the different types of micro	bial interac	tions and	l bio	geo	ocher	nical	cycle	s.	
Unit No.		Content	Contact Hour	Le	arn	ing	Out	come	:		KL
I	Microbi	al Ecology: Interaction between	13	Describ	be, i	llus	trate	and			1,2
	abiotic a	and biotic factors in an ecosystem,		explain							
		cal niche, concept of community,		betwee					ıd		
	l	ion and succession. Ecological		other o					.:		
		l, energy flow, food chain, food webs r dynamism, stability.		ecosyst of micr							
		cy of microbes: Microbial		of microorganisms in the environment							
		nities in terrestrial and aquatic,									
		es in extreme environments –									
		philes, psychrophiles, barophiles,									
		iles, alkaliphiles and halophiles, Role mposers, Microbiology of air,									
	l	ation of air microflora.									
II		Microbiology: The aquatic	10	Describ	be, i	llus	trate	and			1,2
	environ	ment - major environmental		explain	the	Ac	uatic	;			
	l	ons influencing microflora.		enviror							
		ation of microorganisms in the aquatic		microo					in		
		ments - freshwater environment, s and marine environment.		the wat					logy		
		ology of drinking water, water		and pu							
	l	n, purification of water for human		water.					8		
		ption. Assessment of microbial status									
		and waste water. Wastewater									
		eristics, Bacterial indicators –									
III		DD, COD. crobiology: Soil microbes and soil	7	Describ	ne i	11115	trate	and			1,2
111		Nitrogen fixation: Biochemistry of	,	explain					sent		1,2
	Nitroge	n fixation - mechanism of nitrogenase		in the soil and their role in			in				
		genase - Assay of nitrogen fixation -		nitroge			on er	nrichi	ng		
		ogy of legume root nodule,		soil fer	tility	у.					
	leghaemoglobin - Synthesis, Genes involved in nitrogen fixation										
IV					1,2						
• •		affecting the bioremediation process,		explain							- ,
	Biorem	ediation of toxic waste sites;		microb	ial i	nte	ractio	n wit			
		ediation practices and technologies;		other o				d the	role		
		hing of copper - Role of microbes;		of micr				-1			
	Microbi	al degradation of environmental		biogeo	chei	nıc	al cy	cles			

	pollutants- industrial solvents, pesticides, petroleum hydrocarbons, xenobiotics; Biodeterioration  – paper, textile, wood, metal, Corrosion			
V	Microbial interaction: Competition, ammensalism, parasitism, mutualism, commensalism, synergism. Biogeochemical cycles – Carbon, Nitrogen.	7	Describe, illustrate and explain the technique of electrophoresis and spectroscopy in terms of its working principle and applications.	1,2
Practical	<ol> <li>Isolation and enumeration of air microbes by gravity settle method</li> <li>Measurement of pH of given environmental samples</li> <li>Isolation, Enumeration and Bacteriological examination of water samples</li> <li>Isolation of microorganisms from soil samples</li> <li>Isolation of microorganisms from other environmental samples</li> </ol>	30	Describe, illustrate and explain the isolation of microorganisms from various sectors of environment like air, soil and water and study the types of microorganism present	1,2,3,4

- 1. Environmental Microbiology by Eugene L Madsen
- 2. Environmental Microbiology, Blackwell Synergy, Blackwell publishing
- 3. Environmental Microbiology by P D Sharma, Alpha Science publishing
- 4. Environmental Microbiology by Alan and Malcolm

#### **REFERENCE BOOKS:**

- 1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. Mc Graw Hill Book Company
- 2. Prescott, Harley and Klein's Microbiology.
- 3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson
- 4. Experiments in Microbiology, Plant Pathology and Biotechnology by K.R. Aneja

#### OTHER LEARNING RESOURCES:

https://microbenotes.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Enumerate the microbial diversity and their extreme habit	1,2,8					
2	Illustrate the occurrence and distribution of microorganism in the aquatic environment.	1,2,4,8					
3	Describe the role of microorganisms in nitrogen fixation and the genes involved.	1,2,3,8					
4	Explain the role of microorganism in degradation of environmental pollutant and Bioremediation.	1,2,3,4,8					
5	Describe the different types of microbial interactions and biogeochemical cycles.	1,2,3,4,8					

	SEMESTER – II											
	se Title		Enzym Total Credits:	es and Me	<u>tabolism</u>	L	Т	P	S	R	O/F	С
Cour	se Code	24BSMB123R	Total Hours: 45T+30P				0	2	0	0	0	4
Pre-r	equisite	Nil	Со-1	requisite					Ni	il		
Progr	ramme		Bachelor of S	Science in M	Microbio	log	y					
Seme	ester	-	g/ II semester (									
l .	ourse ectives	<ol> <li>Understand enzymapplications.</li> <li>Describe the types,</li> <li>Analyze carbohydregulatory mechanist</li> <li>Explain the roles of nitrogen fixation in</li> </ol>	functions, and orate and protosms.	deficiency of the deficiency o	disorders olism, ir	of nclu	vita ıdin	ımins g k	s and	l mii path	nerals ways	and
(	C <b>O</b> 1	Describe enzymes, enzy	me kinetics, in	cluding car	bohydrat	tes,	and	l pro	teins	met	abolis	sm.
C	CO2	Explain the physiologi overall growth and deve				ls a	ınd	thei	r co	ntrib	oution	for
C	CO3	Describe the generation regulation.										
	CO4	Illustrate the interconn associated metabolic pa	thways.									
Unit	CO5	Analyze the physiologic Content	al effects of gr	Contact				Oute				nent KL
No.		Content		Hour	Lea	11 111	ing	Out	com	C	15	XL/
I	Charac Coenzy mechan Induce (Micha	e: History, Terminology, teristics Classification, no yme; cofactor; active site; nism action (Lock & key d fit model), Enzyme Kirnelis - Menten equation, L lot), Enzyme (inhibition, ation).	omenclature; ribozyme; model; etics ine weaver	13	Describ explain kinetics	and					1	,2
II	Vitami	ns and Minerals: Definitions; classification; source		10	Describe explain and fun	the oction	typ ons	pes, s	sourc	ces	1	,2
III	III Carbohydrate metabolism: Glycolysis, 7 Descr oxidation of pyruvate, TCA cycle, explain metabolism of glycogen, gluconeogenesis, carbol			Describ explain carbohy	and minerals.  Describe, illustrate and explain the pathway for carbohydrate metabolism and the enzymes involved.				,2			
IV	Protein Oxidat decarbo	Metabolism- Degradation ive, non-oxidative deamino acids, eatinine formation.	n of proteins, nation and	8	Describe, illustrate and explain the pathway for protein metabolism and the enzymes involved.			,2				
V	Gibber ethyler photos pathwa metabo	rowth regulators - Auxin ellins, Cytokinin's. Absc e. Photosynthesis- Struct ynthetic apparatus, C3 an eys, Light and Dark reactions and fixation of n nous plants.	sic acid and ure of d C4 on, Nitrogen	7	enzymes involved.  7 Describe, illustrate and explain the plant growth regulators and their functions, and also explain and illustrate CO2 and N2 fixation.				,2			

	A. Quantitative estimation of	30	Describe, illustrate and	1,2,3,4
l _	1. Proteins (Lowry's method).		explain estimate the	
င်အ	2. DNA (Diphenylamine method),		sugars, proteins, DNA,	
cti	3. RNA (Orcinol method),		RNA and amino acids of	
Practical	4. Amino acids (Ninhydrin reaction),		given sample and extract	
_	5. Sugars (Dinitrosalicylic acid method).		protein from milk.	
	B. Extraction of Protein from milk,			

T1. U Satyanarayana. Biochemistry. 13th edition. Elsevier Health Sciences; 2017.

### **REFERENCE BOOKS:**

- R1. David L. Nelson, Michael Cox. Lehninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R2. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.
- R3. Voet and Voet. Biochemistry. 3rd edition. John Wiley & Sons, 2004.

### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Describe enzymes, enzyme kinetics, including carbohydrates, and proteins metabolism.	1,2,3,8				
2	Explain the physiological roles of vitamins and minerals and their contribution for overall growth and development of the human body.	1,2,8				
3	Describe the generation of cellular energy through carbohydrate metabolism and its regulation.	1,2,3,8				
4	Illustrate the interconnection between protein metabolism in our body and different associated metabolic pathways.	1,2,3,8				
5	Analyse the physiological effects of growth regulators in plant growth and development	1,2,3,4,8				

		SF	EMESTER -	· II						
Cours	Course Title Environmental Studies									
Cours	se code	24UBES101R Total Co	redits: 2 ours: 30	L 2	T 0	P 0	S 0	R	O/I 0	F C 2
Pre-re	equisite		Co-requisite		U	U	Nil	U	U	
	amme		r of Science	n Microbio	logy					
Seme		Spring/ II seme				mma	<u>د</u>			
Seme		1. To prepare students for careers						sino	comi	nlex
		environmental issues from a pr			_			_	Com	ртел
Co	urse	2. To develop a world population			_		_		ironn	nent
	ectives	and its associated problems								
J		motivations and commitment to				-				
		of current problems and preven	tion of new o	ones.						
		3. To gain knowledge about the co	onservation o	f biodiversit	y and i	its im	porta	ince.		
(	201	The students will be able to appro							l con	text
	.01	of environmental issues and the l								
C	<b>O2</b>	Students will learn about natural Human activities on natural resou		importance a	and en	viron	ment	al in	npact	ts of
		Gain knowledge about environment		stem. Stude	nts wi	11 be a	able t	o un	dersi	tand
C	<b>O</b> 3	the concept of biodiversity and re								
C	<b>O</b> 4	Gain knowledge about the conser	vation of bio	diversity an	d its in	nport	ance.			
C	05	Aware students about problems	of environme	ental polluti	on, its	impa	act of	n hu	man	and
	<del></del>	ecosystem and control measures.		_						
Unit No.		Content	Contact Hour	Lear	ning (	Jutco	ome		ŀ	KL
I I	Multid	isciplinary nature of	4	Environme	ental st	udies	3			1,2
		mental studies: Definition, scope		combines				e		,
	and imp	portance, Need for public awareness	s.	environme						
				multidiscip				18		
				key to solv problems.	_	_		S		
				and educat				J		
				promoting	sustai	nabil	ity			
II		l Resources: Renewable and non-	6	Natural re					1	1,2
		ble resources, Natural resources		renewable				ble,		
		ociated problems. Forest resources: I over-exploitation, deforestation,		face exploincluding						
		idies. Timber extraction, mining,		overuse of				•		
	dams ar	nd their effects on forest and tribal		environme	ntal cl	nallen	ges v	vith		
		Water resources: Use and over-		minerals a		-				
		on of surface and ground water, drought, conflicts over water, dams		degradatio				ay a		
		and problems. Mineral resources:	-	resources a			_			
		d exploitation, environmental effects	S	sustainabil	_		8			
of extracting and using mineral resources,										
	case studies. Food resources: World food problems, changes caused by agriculture									
		ns, changes caused by agriculture ergrazing, effects of modern								
		ture, fertilizer-pesticide problems,								
_		ogging, salinity, case studies. Energ	у							
		es: Growing energy needs,								
		ble and non-renewable energy								
		, use of alternate energy sources. udies. Land resources: Land as a								
		e, land degradation, man induced								

	landslides, soil erosion and desertification.			
	Role of an individual in conservation of			
	natural resources. Equitable use of			
	resources			
	for sustainable lifestyles			
III	Ecosystems: Concept of an ecosystem.	4	This module covers	1,2
	Structure and function of an ecosystem.		ecosystems, including their	,
	Producers, consumers and decomposers.		concept, structure,	
	Energy flow in the ecosystem. Ecological		functioning, and diversity.	
	succession. Food chains, food webs and		Students will learn about	
	ecological pyramids. Introduction, types,		energy flow, ecological	
	characteristic features, structure and		succession, and various	
	function of the Following ecosystem: -		ecosystem types like forests,	
	Forest ecosystem, Grassland ecosystem,		grasslands, deserts, and	
	Desert ecosystem, Aquatic ecosystems		aquatic ecosystems.	
	(ponds, streams, lakes, rivers, oceans,			
	estuaries)			
IV	Biodiversity and its conservation:	5	This module covers	1,2
-	Introduction – Definition: genetic, species		biodiversity, including its	-,-
	and ecosystem diversity. Bio-geographical		definition, value, levels, and	
	classification of India. Value of		threats. Students will learn	
	biodiversity: consumptive use, productive		about India's bio-geographical	
	use, social, ethical, aesthetic and option		classification, its status as a	
	values. Biodiversity at global, National and		mega diversity nation, and key	
	local levels. India as a mega diversity		biodiversity hotspots. They'll	
	nation• Hot-sports of biodiversity. Threats		also explore threats like habitat	
	to biodiversity: habitat loss, poaching of		loss, wildlife poaching, and	
	wildlife, man-wildlife conflicts.		human-wildlife conflicts,	
	,		crucial for conservation efforts.	
V	Environmental Pollution: Definition	5	This module covers	1,2
	Cause, effects and control measures of:-Air		environmental pollution,	
	pollution, Water pollution, Soil pollution,		including causes, effects, and	
	Marine pollution, Noise pollution, Thermal		control measures, alongside	
	pollution, Nuclear hazards. Solid waste,		waste management and	
	Management: Causes, effects and control		disaster preparedness	
	measures of urban and industrial wastes.		strategies.	
	Role of an individual in prevention of			
	pollution. Pollution case studies. Disaster			
	management: floods, earthquake, cyclone			
	and landslides.			
VI	<b>Social Issues and the Environment:</b> From	6	This module explores social-	1,2
	Unsustainable to Sustainable development.		environmental dynamics,	
	Urban problems related to energy. Water		including urban energy	
	conservation, rain water harvesting,		challenges, water conservation,	
	watershed management. Resettlement and		and resettlement issues. It	
	rehabilitation of people; its problems and		delves into environmental	
	concerns. Case Studies. Environmental		ethics, climate change impacts,	
	ethics: Issues and		and relevant legislation like the	
	possible solutions. Climate change, global		Environment Protection Act,	
	warming, acid rain, ozone layer depletion,		emphasizing public awareness	
	nuclear accidents and holocaust. Case		and enforcement challenges.	
	Studies. Waste land reclamation.			
	Consumerism and waste products.			
	Environment  Protection Act Air (Provention and Control			
	Protection Act. Air (Prevention and Control of Pollytion) Act. Water (Prevention and			
	of Pollution) Act. Water (Prevention and			
	control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.			
	Issues involved in enforcement of			

	environmental legislation. Public awareness.			
VII	Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.	4	This module covers human population dynamics, including growth, impact on the environment and health, along with initiatives like Family Welfare Programs and the role of information technology, illustrated with case studies.	1,2
VIII	Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)	5	Fieldwork objectives include documenting environmental assets like rivers and forests, assessing pollution in urban or rural sites, and studying local biodiversity and ecosystems such as ponds and hill slopes	1,2

T1. Bharucha. Textbook of Environmental Studies for Undergraduate Courses. 2nd edition. Orient Black Swan Publishing; 2019.

### **REFERENCE BOOKS:**

- R1. Trivedy Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R). B.S. Publications; 2010.
- R2. Trivedi, Goel. Introduction to air pollution. 1st publication. Techno-Science Publication (TB); 2003.

# **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/22274891/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	The students will be able to appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.	1,4,6,8					
2	Students will learn about natural resource, its importance and environmental impacts of Human activities on natural resource	1,2,4,6,8					
3	Gain knowledge about environment and ecosystem, Students will be able to understand the concept of biodiversity and respect them	1,2,4,6,8					
4	Gain knowledge about the conservation of biodiversity and its importance.	1,4,6,8					
5	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.	1,2,4,5,8					

SEMESTER – II  Course Title Implicative English (Communicative English & Soft Skills)												
Cours	se Title	Im								_	í	
Cours	se code	24UBPD121R	<b>Total Credit Total Hours</b>		L 0	T 0	P 2	S 0	R 0	0/F 0	C 2	
Pre-re	equisite	Nil	Co-req	uisite				Nil				
Progr	amme	]	Bachelor of S	science i	in Microbi	iolog	y					
Semes	ster	Spring/	II semester o	of first y	year of the	Pro	gran	ıme				
1	ourse ectives	<ol> <li>To equip students with the skills to interchange sentence types, use various tenses, and correct common grammatical errors.</li> <li>To enable students to effectively use one-word substitutions, understand homonyms and homophones, avoid commonly confused words, and use idioms and phrases.</li> <li>To help students understand the nature and types of listening, and overcome barriers to effective listening.</li> <li>To enable students to apply effective reading techniques, gather information from texts, and use the SQ3R technique.</li> <li>To teach students the importance of time management and basic strategies to maintain it.</li> <li>To guide students in developing a comprehensive and professional LinkedIn profile.</li> </ol>										
(	C <b>O</b> 1	Provide students with the and address common gran			n sentence	type	s, uti	lize o	diffe	rent te	enses,	
C	CO2	Empower students to prohomonyms and homopho and phrases in their vocal	nes, avoid fre									
C	CO3	Assist students in compilied identifying and overcomi	ng obstacles t	o effect	ive listenin	ıg.						
C	CO4	Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.										
C	CO5	Instruct students on the significance of time management and provide foundational strategies to manage their time efficiently.										
C	CO6	Lead students in creating a well-rounded and professional LinkedIn profile.										
Unit No.		Content		ntact Iour	Lea	rnin	g Ou	tcom	ie		KL	
I	i. Interc Asser Asser ii. Type iii. Con	change of Interrogative and trive Sentences, Exclamator trive Sentences of Tenses change Errors  Ilary Development		6	Students v construct a sentence t grammatic	and to ypes cal er	ransf and o	orm v	et	us	1,2, 3	
	i. One ii. Hor iii. Wo	e word substitution monyms and Homophones ords often confused oms and phrases			vocabular accurately	y and	l use	word			1,2, 3	
III				5	effective l identify lis	Students will demonstrate 1,2,3 effective listening skills and identify listening barriers.						
IV	i. Techi ii. Gath text	g Skills  niques of Effective Reading ering ideas and information  SQ3R Technique		5	Students v and extrac using the	t rele	evant	info	mati		1,2, 3	

V	Time-Management Skills	4	Students will effectively	1,2, 3
	i. Introduction to Time Management		manage their time using various	
	ii. Purpose and Importance of Time		strategies.	
	Management		-	
	iii. Basic Tips to Maintain Time			
VI	Creation of LinkedIn Profile	6	Students will create a	2, 3
			professional LinkedIn profile.	

- 1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writingand Speaking, Zephyros Press.
- 2. Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- 4. Murphy, Raymond,.(2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English ,Cambridge University Press

#### OTHER LEARNING RESOURCES:

https://www.ef.com/wwen/english-resources/

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Provide students with the ability to transform sentence types, utilize different tenses, and address common grammatical mistakes.	2,5,8
2	Empower students to proficiently apply one-word substitutions, differentiate between homonyms and homophones, avoid frequently confused words, and incorporate idioms and phrases in their vocabulary.	2,5,8
3	Assist students in comprehending the various aspects and types of listening, and in identifying and overcoming obstacles to effective listening.	2,5,6,8
4	Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.	2,5,8
5	Instruct students on the significance of time management and provide foundational strategies to manage their time efficiently.	2,6,7,8

			SEMESTER	. – II							
Course	e Title		Co-Curricula	r Activities	S						
Course	e code	14118661718	otal credits: 1 otal hours: 60			T 0	P 0	S 4	R	0/F 0	C 1
Pre-ree	quisite	Nil	Co-requi			-		Nil		1 -	
Progra	ımme		Bachelor of S	cience in N	Aicrob	iolog	зу				
Semest	ter	Spring	/ II semester o	of first year	r of the	Pro	grar	nme			
Course Objectives		<ol> <li>Develop students' interpersonal skills, emotional intelligence, and teamwork abilities through participation in diverse co-curricular activities.</li> <li>Foster leadership qualities and organizational skills by providing opportunities for students to take on leadership roles and manage events or projects within co-curricular activities.</li> <li>To be aware of their role in society and contribute positively.</li> </ol>									
CO	01	Improve Interpersonal a others and communicate		Skills- St	udents	will	lear	n to	wor	k well	with
CC	)2	Develop Time Managen their time and stay organ		nizational S	Skills -	Stud	lents	will	learr	n to ma	anage
CC	03	Boost Creativity and Cr and think more critically		g - Student	s will	enhai	nce t	heir	creat	ive ab	ilities
CO	04	Promote Physical and M reduce stress.									
CC	<b>D</b> 5	Encourage Social Responsive aware of their role in social Responsive aware awar	•	bute positiv	vely.						
Unit No.		Content		Contact Hour	Le	arni	ng O	utco	me		KL
I	improvide velo organizeritical mental responsive will en workship their ir social and Renow workship evaluate workship evaluate workship evaluate workship experies with other manageries organizerity health,	on the learner's interest the ring interpersonal and tear ping time management and zational skills, boosting or thinking, promoting physhealth, and encouraging sibility and civic engagem gage in regular club activitions, and competitions that terests and hobbies, foster and emotional development and professionals will cornops to enhance students' to ments will include participes, reflection essays, journ thous of their involvement mops and events. Through theres, communicate effective their time, stay organized ity, think critically, improveduce stress, and contributely to society.	nwork skills, d eativity and ical and ocial eent. They ties, t align with ring their nt. nduct alents. pation in nals, and in these o work well vely, d, enhance ve their	60	By pa sports curric throug studer physic agility teamy They manag practi throug renow and b while growt promo aware lifelon encou pursu develo cultiv that et acade	ular wular w	sic, a active nivers vill de nd maders la contract en nd en	and contities sity contents on the contents on	oronoffer lubs, pp tivity time with nals, dence onal lities tty, and the state of t	red 7.	1,2

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Improve Interpersonal and Teamwork Skills- Students will learn to work well with others and communicate better.	6,7						
2	Develop Time Management and Organizational Skills - Students will learn to manage their time and stay organized.	6,7						
3	Boost Creativity and Critical Thinking - Students will enhance their creative abilities and think more critically.	6,7						
4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.	6,7						
5	Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.	5,6,7						

			SEMESTEI	R – III						
Cours	se Title			Immunolo	gy					
Cours	se code	24BSMB211R	Total credits: 4	1	LT	P S R	O/F	C		
			Total hours: 4		3 0	2 0 0	0	4		
	equisite	Nil	Co-requ			Nil				
Progr	amme		Bachelor of S	Science in N	Microbiology					
Seme	ster		III semester of							
		1. Identify and describe the contributions of key scientists to the development of								
		<ul><li>immunology.</li><li>2. Explain the functions and properties of various immune cells and organs.</li></ul>								
	ourse	_				-	1			
Obj	ectives	3. Differentiate betw interactions.	een types of	immunity	and under	estand antibo	dy-anti	gen		
		4. Analyse hypersensitivity, autoimmunity, vaccines, secondary immunodeficiency,								
		4. Analyse hypersensitivity, autoimmunity, vaccines, secondary immunodeficiency, and graft types.								
	CO1	Describe the historical	prospect and co	ncept of in	nate and adan	tive immunity				
	202	Illustrate the properties								
	203	Discuss the structure ar				01841101				
	CO4	Apply the principle of				n of disease				
	CO5	Identify immunologica								
Unit	<u> </u>	Content		Contact				L		
No.				Hour						
I		t of Innate and Adaptive		10	Describe, ill			,2		
	1	utions of following scient ment of field of immuno			scientists to	contributions (	OI			
		Karl Landsteiner, Rober			developmen					
		Elie Metchnikoff, Peter		Immunolog						
	1	lane Burnet, Neils K Jer								
II		nd Susumu Tonegawans and Properties of: Imi	nune Cells _	10	Describe, ill	ustrate and	1	,2		
11		ell, T cell, B cell, NK cel	10	explain abou		1	,2			
	Macrop	hage, Neutrophil, Eosino		cells their fu						
	_	il, Mast cell, Dendritic co		properties						
	1	e Organs – Bone Marrow Node, Spleen, GALT, M								
III		ty – types - active passiv		8	Describe, ill	ustrate and	1.	,2		
	1	structure, antigens– pro	•		explain the	different types				
	happens	5,				, properties of				
					antibody, an	itigen, happen	S			
					antibody	<b>C</b> 01				
IV		-antibody reactions – ag		8	Describe, ill			,2		
		ation, immune diffusion,				knowledge on				
	monocl	onal antibodies functions	3		immune tecl	nd process of				
V	Hyperse	ensitivity – types, autoim	munity-	9	Describe, ill		1.	,2		
		accines – types, seconda	-			different types		,		
	immuno	odeficiency, graft and its	types		of Hypersen					
					vaccines, gr secondary in					
					deficiency	mmune				
7	1. AB	O Blood Grouping and R	th typing	30	Proficiency	in various	1,2	2,3,4		
Practical	2. Pred	cipitation reaction: ODD	, RÍĎ,		diagnostic d					
rac		DAL, VDRL / RPR, ASC			diagnosis					
Ь	3. Der	nonstration of RIA and I	ELISA							

- 1. Immunology by Kuby, W.H Freeman & Co.
- 2. Immunology and Immunotechnology by Chakraborty, Oxford University Press
- 4. Clinical Immunology: Principles and Practice. Robert R. Rich, Thomas A. Fleisher, William T. Shearer, Harry W. Schroeder Jr., Anthony J. Frew, Cornelia M. Wey and. Elsevier Health Sciences, 2018
- 5. Basic Immunology, 6e: South Asia Edition Paperback, 2019, by, Andrew H. Lichtman, Shiv Pillai.
- 6. Practical Immunology, 4th Edition, C. Hay, Olwyn MR Westhood, Blackwell Series. 2008.

### **REFERENCE BOOKS:**

- 1. <u>Cellular and Molecular Immunology; Abbas and Lichtman. ed.: Malley, J.; Schmitt, B. Fifth edition, updated.</u> Elsevier Saunders, 2005.
- 2. An Introduction 1st Edition (English) 4th Edition, Ian Tizard, Brooks/Cole publication

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the historical prospect and concept of innate and adaptive immunity.	1,2,8					
2	Illustrate the properties and functions of different Immune cell, organs.	1,2,8					
3	Discuss the structure and properties of antigen and antibody.	1,2,3,8					
4	Apply the principle of antigen antibody interaction for detection of disease	1,2,3,8					
5	Identify immunological disorders like hypersensitivity and autoimmunity.	1,2,3,6,8					

			SEMEST	ER – III							
Cour	se Title		I	Microbial C	Genetics	3					
Cours	se code	24BSMB212R	Total credi	its: 4 s: 45T+30F	$\frac{L}{3}$	T 0	P 2	S	R	O/F 0	C 4
Pre-r	equisite	Nil		equisite		. <u> </u>		Ni		<u> </u>	<u> </u>
Progr	ramme		Bachelor o	of Science in	Micro	biolo	gy				
Seme	ster	Fall/ II	II semester	of second ye	ear of t	he Pı	rogra	mme	2		
Course Objectives		<ol> <li>Understand the detailed structures of DNA forms (Z-DNA, A &amp; B DNA) and genome organization in prokaryotes and eukaryotes.</li> <li>Explain DNA replication mechanisms, transcription processes, and RNA types and their processing.</li> <li>Analyse gene regulation mechanisms, mutagens, mutations, and DNA repair processes.</li> <li>Describe bacterial recombination, transformation, conjugation, transduction, and transposable elements.</li> </ol>									
(	C <b>O</b> 1	Describe the DNA struc	cture and its	mode of rep	lication	۱.					
(	CO2 Illustrate the concept of transcription, post transcriptional modification, translation post translational modification in prokaryotic and eukaryotic cells.  CO3 Describe the DNA mutation, damage and their repair mechanism.  CO4 Explain bacterial recombination in different mode of gene transfer									tion,	
	CO5	Outline transposable ele									
Unit		Content	ements and t	Contact				utco	me		KL
No.	D 4 11 1	CDMA Z DM	A A 0 D	Hour	D '	. 11	1 4	4	1		1.0
I	DNA, Go and euka replication Modes of mechanism	f DNA replication- Detai sm of Semiconservative r c: nature, classification, p	okaryotes d in DNA led replication.	9	Descrii explair organiz their M	the zation	struc 1 of I	tural DNA	and		1,2
II	Prokaryo Structure RNA, t-F Wobble Prokaryo modifica expressio operons,	otic and eukaryotic transce and processing of m-RN RNA. Ribozyme, Genetic hypothesis, Translation in otes. Post translational tions, Gene regulation and tion – Lac operon, tryptophygene rearrangement, proceedings of the control of	VA, r- code and n ad nane	10	Descrii explair as trans transla prokar	n abo script tion i	ut pro tion a n bot	ocessond and ah	es suc	eh	1,2
Ш	mutation directed and repair Bromide and repair	mutagens, molecular bass, analysis of mutations, mutagenesis. Detailed mair mechanism of UV, Eth and Nitrus oxide. DNA our mechanisms.  and applications of mutagenesis.	8	Describe, illustrate and explain about the different types of mutations and their role in evolution						1,2	
IV	Bacterial transfer, efficience	Recombination's- Discomolecular mechanism, do y calculation and applica transformation- Compet	etection, tions.	10	Describe, illustrate and explain the different methods of transfer of genes from one organism to another					ds	1,2

	Bacterial conjugation – Sex factor in bacteria, F and HFR transfer, linkage mapping. Bacterial transduction– transduction phenomenon, methods of transduction, generalized, specialized and abortive transduction, sex-ductions			
V	Transposable elements – Definition, detection of transposition in bacteria, types of bacterial transposons and applications of transposons	8	Describe, illustrate and explain about the rearrangement of genes are major force in evolution	1,2
Practical	<ol> <li>Gel casting and gel loading</li> <li>Isolation of DNA, protein</li> <li>Agarose Gel Electrophoresis, PAGE</li> <li>Demonstration of conjugation, transformation and Transduction</li> <li>Blotting techniques</li> </ol>	30	Proficiency in various molecular techniques for DNA, protein isolation	1,2,3,4

- 1. Molecular Biology of the Gene 4th edition by J D Watson, N H Hoppkins, Roberts, Steitz and Weiner. 1987. The Benjamin Cummings Publication Co. Inc Californis
- 2. Microbial genetics. David Freifelder Jones and Bartlett, 1987

#### **REFERENCE BOOKS:**

- 1. Microbial genetics by Maloy et al. 1994, Jones and Bartlett Publishers
- 2. Molecular Genetics of Bacteria by J W Dale, 1994, John Wiley and Sons
- 3. Modern Microbial Genetics. 1991 by Streips and Yasbin. Niley Ltd.

# **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the DNA structure and its mode of replication.	1,2,3,8							
2	Illustrate the concept of transcription, post transcriptional modification, translation, post translational modification in prokaryotic and eukaryotic cells.	1,2,3,8							
3	Describe the DNA mutation, damage and their repair mechanism.	1,2,3,8							
4	Explain bacterial recombination in different mode of gene transfer	1,2,3,7,8							
5	Outline transposable elements and their different application.	1,2,3,7,8							

			SEMEST	ER – III							
Cours	se Title		Agricultural	Microbiol	ogy and	l Plar	ıt Pa	tholo	ogy		
Cours	se code	24BSMB213R	Total credits Total hours:		L 3	T 0	P 2	S	R	O/F 0	C 4
Pre-r	equisite	Nil		quisite	- 3	U	<u> </u>	Ni		U	4
	amme		Bachelor	of Science i	n Micro	biol	ogy				
Seme	ster	Fall	/ III semester	of second y	ear of	the P	rogr	amm	e		
Course Objectives		<ol> <li>Understand soil composition, microorganisms, and microbe-plant interactions, including siderophore roles.</li> <li>Explain the nitrogen cycle, symbiotic and non-symbiotic nitrogen fixation, nitrogenase function, and if gene importance.</li> <li>Apply knowledge of biofertilizers, biopesticides, genetic transformation, and cyanobacteria in agriculture.</li> <li>Analyze host-parasite interactions, pathogenesis mechanisms, phytoalexin production, and strategies for plant disease control.</li> </ol>									
	CO1	Describe soil profil dynamics of positive comprehending the and plants.	e and negative	ve interaction	ons bet	ween	mic	robes	and	plants	and
	C <b>O2</b>	Proficient understar non-symbiotic nitro functions and articul	gen fixation ation of the in	mechanisms	s, clarif f nif gen	ication	n of	nitr gen 1	ogena	ase enz oolism.	zyme
	C <b>O3</b>	Applying the use biopesticides for ins transformation and A	ect control, an Agrobacterium	d recognizir -mediated g	ng the ir gene tran	nport isfer.	ance	of Ti	plas	mid in j	plant
•	C <b>O4</b>	Analyze host-parasi identify primary dunderstand phytoale	isease detern xin production	ninants, exp	plore p fense.	athog	genes	sis n	necha	nisms,	and
	C <b>O5</b>	Study key plant diseases and their control methods and preventive strategies for post-harvest disease control.									
Unit No.		Content		Contact Hour	L	earni	ng O	utco	me		KL
I	Microorga Environm Positive a Interaction	les: Composition and anisms in Soil and Pla ents nd Negative Microbe- ns. Role of Sideropho Plant Relationships	nt -Plant	9	Descri composidentif microo plant-r and ev siderop relatio	sition y soil organ nicro aluate ohore	n and and isms, be in the the	structure plant analyteractrole	eture, t yze tions,		1,2
II	vs. Non-S Function	of the Nitrogen Cyclo ymbiotic Nitrogen Fix of Nitrogenase Enzym ce of nif Genes in Nitrom	xation. ne.	7	Describe, illustrate and explain about Nitrogen Fixation. Function of Nitrogenase Enzyme and Importance of nif Genes in Nitrogen Metabolism					L	1,2
III	Transforn as bioferti methods. action, an plasmid a Agrobacte	1						oferti	ilizers	δ,	1,2

IV	Host-Parasite Interactions: Host parasite interaction, enzymes and toxins in relation to plant disease, primary disease determinant, mechanism of pathogenesis. Phytoalexin production and its role in plant defence.	8	Describe, illustrate and explain the host-parasite interactions, the roles of enzymes and toxins in plant diseases, primary disease determinants, pathogenesis mechanisms, and phytoalexin production in plant defense.	1,2
V	Major diseases in Plants: Study of the following diseases and their methods of control: late blight of potato, leaf spot disease of rice, loose smut of wheat, red rot of sugarcane, citrus canker and mosaic disease of tobacco. Preventive strategies for post-harvest disease control.	12	Describe, illustrate and explain about different plant diseases caused by microorganisms and implement effective preventive strategies for post-harvest disease control.	1,2
Practical	<ol> <li>Isolation of bacteria and fungi from soil.</li> <li>Isolation of nitrogen fixing bacteria from legume root nodules.</li> <li>Isolation of phyllosphere microflora.</li> <li>Study the symptoms, causal agents, and epidemiology of plant diseases.</li> </ol>	30	Proficiency in isolating bacteria and fungi from soil, nitrogen-fixing bacteria from legume root nodules, phyllosphere microflora, and studying symptoms, causal agents, and epidemiology of plant diseases.	1,2,3,4

- 1. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
- 2. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.
- 3. Plant Pathology by G.N Agriose: January 2000, Academic Press

### **REFERENCE BOOKS:**

- 1. Microbiology Michael J. Pelczar, JR. E. C. S. Chan Noel K. Krieg, Vth Edition (2005), Publisher TATA Mc Graw Hill.
- 2. Plant Diseases R.S. Singh, IXth Edition, Oxford and IBH (N. Delhi).
- 3. Plant Pathology. J. C Walker, 1999 by the National Academy Press Washington.

# **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome			
1	Describe soil profiles, recognize microorganisms in soil and plants, and grasp the dynamics of positive and negative interactions between microbes and plants and comprehending the role of siderophores in nurturing relationships between microbes and plants.	1,2,8			
2	Proficient understanding of the nitrogen cycle, distinction between symbiotic and non-symbiotic nitrogen fixation mechanisms, clarification of nitrogenase enzyme functions and articulation of the importance of nif genes in nitrogen metabolism.	1,2,3,8			
3	Applying the use of associative cyanobacteria as biofertilizers, evaluating biopesticides for insect control, and recognizing the importance of Ti plasmid in plant transformation and Agrobacterium-mediated gene transfer.	1,2,3,4,8			
4	Analyze host-parasite interactions, examine enzymes and toxins in plant diseases, identify primary disease determinants, explore pathogenesis mechanisms, and understand phytoalexin production in plant defense.	1,2,3,6,8			
5	Study key plant diseases and their control methods and preventive strategies for post-harvest disease control.	1,2,3,4,8			

			SEMESTEI	R – III								
Cou	Course Title English Language for Excellence											
Cou	rse code	741 RPITTITR	Fotal credits:		L 0	T 0	P 2	S	R 0	O/F	_	<u>C</u>
Pre-	requisite	Nil	Co-requ		-			Nil				
	gramme		Bachelor of S		⊥ Micro	biolo	σv					
<u> </u>	ester	Fall/ II	I semester of					mme				
Sciii	CSTCI	1. To understand and a				пстт	ogra					
Course Objectives  2. To develop clear and structured writing skills. 3. To cultivate self-management skills. 4. To understand and utilize non-verbal communication. 5. To enhance group discussion skills 6. To master interview skills and dress code ethics												
•	CO1	Enable students to us sentences, and distingui					comp	lex,	and	comp	oun	ıd
(	C <b>O2</b>	Teach students the basiletters, and prepare resu			oid an	nbigu	ity, v	write	parag	graph	s an	ıd
(	C <b>O3</b>	Help students conduc personal hygiene.										
(	C <b>O4</b>	Equip students with k language, and their imp		out non-ver	bal c	ommı	ınica	tion,	type	s of	bod	ly
(	C <b>O</b> 5	Train students in planni and summarizing to atta		cting group	discu	ssion	s, eff	ective	ely di	isagre	ein	g,
(	C <b>O</b> 6	Prepare students for per telephone interview etic										W
Unit No.		Content		Contact Hour	]	Learn	ing (	Outco	ome		K	L
I	i. Use of ii. Simple	ar (Flipped classroom) Prepositions e, complex, compound se e and Passive Voice	ntences	6	Students will correctly prepositions, create va sentence structures, an convert between active passive voice.			vario and	us	2,	3	
II	Writing Skills  I. The Basics of Writing; avoid amb and vagueness II. Paragraph Writing III. Letter Writing IV. Resume and Cover Letter			6	and s	ents v structi rs, res rs.	ured	parag	raphs		3,	4
III	Self-Management Skills i. SWOT Analysis ii. Self-Regulation iii. Personal Hygiene				5 Students will perform SWOT analyses, self-regulate, and adhere to personal hygiene practices.					es.	3,	4
IV	Non- Verbal Communication-Sciences of Body Language i. What is Non-Verbal Communication & Body Language ii. Types of Body Language, iii. Importance and Impact of Body Language,			5	and o	ents verifiections of bomunic	ively ody l	use d	liffer		2,	3
V	Group I i. Plannii ii. Effect	Discussion  ng and Elements of Group  ively disagreeing,  narizing and Attaining the	o Discussion	5	parti discu	ents v cipate ussion tructi	in g	roup sagree			3,	4

			summarize discussions.	
VI	Interview Skills & Dress code Ethics	5	Students will demonstrate	2, 3
	i. Personal Interview – Concept and Practice		effective interview	
	ii. Common Interview Questions and		techniques, answer	
	answering Strategies		common questions, follow	
	iii. Telephone Interview Etiquettes		telephone etiquettes, and	
	iv. Introduction to Dress Code and Grooming		dress appropriately.	

- 1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2. Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

### **REFERENCE BOOKS:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plover crest Press.
- 4. Murphy, Raymond,.(2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English ,Cambridge University Press

#### **OTHER LEARNING RESOURCES:**

https://learning.shine.com/talenteconomy/career-help/top-group-discussionskills https://www.coursera.org/articles/conflict-management

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Enable students to use prepositions, construct simple, complex, and compound sentences, and distinguish between active and passive voice.	2,5,8				
2	Teach students the basics of writing, how to avoid ambiguity, write paragraphs and letters, and prepare resumes and cover letters.	2,5,8				
3	Help students conduct SWOT analyses, practice self-regulation, and maintain personal hygiene.	2,5,6,8				
4	Equip students with knowledge about non-verbal communication, types of body language, and their impact.	2,5,8				
5	Train students in planning and conducting group discussions, effectively disagreeing, and summarizing to attain objectives.	2,6,7,8				

			SEMESTE	ER – III							
Cour	se Title			ife Saving	Skills (	BLSS	)				
Cour	se code	1 7/11/11/15/2007/12	Total credits: 1 Total hours: 3	l I	T	P 2	S 0	R 0	O/F 0		<u>C</u>
Pre-r	equisite	Nil	Co-requisi		, , 0			il	U		
-	ramme	1	Bachelor of		ı Micro	biolog	ZV				
Seme		Fall/	III semester of					nme			
Seme	<u> </u>								and		otical
	ourse ectives	skills needed in an	The aim of the course is to provide the learners with basic knowledge and practical skills needed in an emergency fire situation, and to provide appropriate basic management and treatment for injuries								
(	C <b>O</b> 1	The students will be oxygen to the patients				rest/ c	ardia	e arre	st, and	d pro	ovide
•	CO2	The students will be a infants victims	able to perform	the impor	tance of	f early	CPR	C on A	Adult,	child	1 and
(	CO3	The students will be relieving pain and pro	_		-		wor	rse, a	iding	reco	very,
C	CO4	Importance of physiol	ogy in forestry								
C	CO5	The students will be operation and getting		oout the fi	re equip	oment	requi	ireme	nts, m	etho	ds of
Unit No.		Content		Contact Hour	Le	arnin	g Ou	tcom	e	K	<b>K</b> L
I	• Introdu • Chain • ABCs • CPR a • AED	ife Support (BLS) uction of BLS of survival Assessment nd Ventilation Techniques of for adult and children		5	Introd life su chain assess	pport, of sur	abou vival,	t the		1	,2
II		Aid den rules of First aid t aid Kits		5	Studenthe go and be utilized effection	lden r able a firs	ules o to pre t aid l	of first epare a kid	t aid and	1	,2
<ul> <li>Introdu</li> <li>Priorit</li> <li>care</li> <li>Scene</li> <li>Primar</li> <li>Bleedi</li> <li>Extrica</li> <li>Cervica</li> <li>applicat</li> </ul>		Trauma emergencies  Introduction Priorities of Initial approach in pre-hospital care Scene safety Primary assessment Bleeding control Extrication of victims and safe transfer Cervical spine stabilization and C-collar application Splinting of broken Limbs		5	Explatraum: methotraum:	a emends of	rgenc mana	ies an ging		1,	2,3
IV Triage • Introd • Flow • Triage		system		5	Illustr systen multip operat	n and o	expla	ins ab	oout	1,2	2,3,4
V	Medica Introduc	l emergencies	lanagement	4	Descriof med	dical e	merg	encie		1,2,	3,4,5

of:-		
• Seizures		
heart attack		
• asthma		
diabetic emergencies		
emergency childbirth		
Respiratory distress and failure		

# **REFERENCE BOOKS:**

R1: Nancy Caroline's Emergency Care in the streets eight edition by Jones and Bartlett

R2: First Aid book by LC Gupta; Publisher Jaypee Brothers, 7th Edition.

# **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	The students will be able to recognize respiratory arrest/ cardiac arrest, and provide oxygen to the patients to sustain tissue viability	2,5,7,8				
2	The students will be able to perform the importance of early CPR on Adult, child and infants victims	2,5,7,8				
3	The students will be able to prevent injury from getting worse, aiding recovery, relieving pain and protecting the victims from deterioration	2,5,7,8				
4	Importance of physiology in forestry	2,4,6,8				
5	The students will be able to learn about the fire equipment requirements, methods of operation and getting out alive.	2,5,7,8				

			SEMESTER	R – III							
Cours	Course Title Personal Financial Planning										
Cours	se code	24UUFL202R	Total credits: 2		L I		S 0	R	0/		C
	equisite	Nil	Total hours: 30 0 0 2 Co-requisite					0	0		2
	amme	INII	Bachelor of S	•	Microl	hiology	Nil	L			
		T7 - U									
Semes	ster		/ III semester of s						4		c
Course Objectives		<ol> <li>The course would offer an inclusive approach to understand the relevant concepts of money, borrowing, lending, taxes and their application to financial planning.</li> <li>Assess the personal financial planning process, the life cycle of financial plans, and methods of goal achievement.</li> <li>Formulate a budget, record-keeping system, and tax planning strategy based on current financial goals</li> </ol>									
(	CO1	Develop a cash man	agement strategy	and a plar	n to fac	cilitate	the ho	me o	r auto	omo	bile
	02	buying process  Design a diversified objectives.									
C	03	Differentiate between			ual fun	ds, exc	hange	-trade	d fur	nds,	and
	004	direct or indirect real estate investments.  Create a financial plan that covers your income needs in retirement and helps prote you and your estate.  Students will be able to analyze and plan effective strategies for managing consum credit, housing, vehicle, retirement needs estate planning and legal protection to ensu financial stability and security.							mer		
Unit		Content	j	Contact	L	earning	g Out	come		K	L
No.	Т	. 1 . 617 1 . 1	\.	Hour	G ₄ 1	. "1	1	•		1	
I	i. Funct ii. Inflat contr iii. proc iv. Time comp v. Net P vi. Powe	nentals of Financial I ions of money; ion- Meaning, causes, colled; ess official planning, e value of money-simp cound interest; resent Value and Futuer of Compounding; abling period and Rule	how it can be le and re value,	6	essei	ents wil ntial kno amental ning	owledg	ge of	al	1	,2
II	II Income Tax Planning— i. Meaning of Income, ii. Direct & Indirect Taxes, Taxable Income various heads of Income for tax Calculation, iii. Non-taxable Income, iv. Tax evasion and tax avoidance, v. GST, Tax Planning Strategies		r tax	6	essei	ents wil ntial kno s in inco ning	owledg	ge and	1	1	,2
III	Entrep	ntrepreneurial planning –				ents wil	_			1	,2
	for be ii. Entre iii. Ins entrep iv. Fina v. Ventu vi. Assi	ing of Entrepreneurshicoming an entrepreneurship Support Stitutional support systomeneurs, incial support systems are Capital, Business Astant of Government, immercial Bank Loans a	bystems in India, ems for for entrepreneurs; Angels,			ntial knos in entr	-	-	1		

IV	Planning for investing in securities market  -  i. Investment avenues offered by Securities Markets, Primary Market and Secondary Market,  ii. Stock market- meaning, features, functions of NSE, BSE DEMAT trading account,  iii. Security repository, stock brokers, Operational aspects of securities markets: placement of orders, contract note, pay-in and pay-out, trading and settlement cycle, iv. Various risks involved in investing in securities markets; Role of Financial Intermediaries; Stock indices.  v. Mutual Funds- meaning concept, definition, types, importance and drawbacks of mutual funds, mutual funds in India, investing in mutual funds, vi. Systematic Investment Plan (SIP) and its advantages.	6	Students will acquire essential knowledge and skills in securities market	1,2
V	Planning for debts and Retirement i. Consumer credit - Introduction to consumer credit; choosing a source of credit, the cost of credit alternatives, ii. Consumer Legal Protection; iii. Housing Decision: Factors and Finance; Vehicle Decisions. iv. Retirement planning - Meaning of cost of living; retirement need analysis; development of retirement plan, various retirement schemes, v. Estate Planning; Pension and Medicare Planning; Wills.	6	Students will acquire essential knowledge and skills in planning for debts and retirement	1,2

### **REFERENCE BOOKS**:

- R1: Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by David J. Mullen Jr.
- R2: Personal Finance and Planning by Dr. Rajni
- R3: Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh

# **OTHER LEARNING RESOURCES**:

https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Develop a cash management strategy and a plan to facilitate the home or automobile buying process	1,2,3,5,7,8				
2	Design a diversified investment portfolio that addresses several different investment objectives.	1,2,3,8				
3	Differentiate between open- and closed-end mutual funds, exchange-traded funds, and direct or indirect real estate investments.	1,2,5,8				
4	Create a financial plan that covers your income needs in retirement and helps protect you and your estate.	1,2,4,5,8				
5	Students will be able to analyse and plan effective strategies for managing consumer credit, housing, vehicle, retirement needs estate planning and legal protection to ensure financial stability and security.	1,2,3,6,8				

			SEMESTE	R – III									
Cours	se Title			alytical Bi	oche	mistry	7						
Cours	se Code	24BSMB214R	Total Credits: Total Hours:	<del> </del>	<b>L</b> 0	T 0	P 2	S 0	R	0/F 0	1		
Pre-r	equisite	Nil	Co-requi	site				Nil					
Progr	ramme		Bachelor of	Science in	Mic	robiol	logy						
Seme	ster	Fall	/ III semester of	second y	ear o	f the I	Progr	amm	e				
	ourse jectives	underlying analyt spectroscopy (UV electrophoresis, ma 2. Quantitative Ana analysis of biomol metabolites using v 3. Sample Preparat handling technique	<ol> <li>Principles of Analytical Techniques: Understand the fundamental principles underlying analytical techniques commonly used in biochemistry, including spectroscopy (UV-visible, fluorescence, IR), chromatography (HPLC, GC), electrophoresis, mass spectrometry, and immunoassays.</li> <li>Quantitative Analysis: Learn how to perform accurate and precise quantitative analysis of biomolecules such as proteins, nucleic acids, carbohydrates, lipids, and metabolites using various analytical techniques.</li> <li>Sample Preparation and Handling: Develop skills in sample preparation and handling techniques essential for biochemical analysis, including extraction, purification, and derivatization methods.</li> </ol>										
(	C <b>O</b> 1	Acquire concept of b	uffer solutions a	nd their ro	le in	variou	s exp	erime	nts.				
(	C <b>O2</b>	Develop basic unders	standing on acid	and base,	pH of	f soluti	ion a	nd use	of p	H mete	neters.		
(	C <b>O3</b>	Apply the principle spectrophotometer.	e of Lambert-H	Beer law	with	the	help	of	color	imeter	and		
(	C <b>O</b> 4	Explain biomolecule separation through thin layer chromatography.											
(	C <b>O5</b>	Demonstrate paper chromatography and its use in amino acids separation											
Unit No.		Content		Contact Hour		Lear	ning	Outc	ome		KL		
I	Preparat	tion of Buffer Solutions	S	5	1	oficien eparati	•	buffe	r	3	3,4, 5		
II	Determi pH mete	nation of pH of given s er	samples using	7	ope vai	oficien eration rious a I meter	and nalyt	functi	ion of	f	3,4, 5		
Ш		tion of Beer- Lambert'		1					ical		3,4, 5		
IV		on of a mixture of lipic nromatography	ls using Thin-	5		oficien romat	-		chniq		3,4, 5		
V		nromatographic separat n of amino acids and si		7	Proficiency in separation and detection of amino acids and simple sugars						3,4, 5		

1. Introductory Biochemistry Practical by Sawhney and Singh, Narosa Publishing House

## **REFERENCE BOOKS:**

- 1. Laboratory manual in Biochemistry Jayaraman.
- 2. Biochemical methods S.Sadasivan and Manickam.
- 3. Introduction to Practical Biochemistry David T. Plummer.

## **OTHER LEARNING RESOURCES:**

ERP, YouTube links, Google etc.

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Acquire concept of buffer solutions and their role in various experiments.	1,2,3,8							
2	Develop basic understanding on acid and base, pH of solution and use of pH meters.	1,2,3,8							
3	Apply the principle of Lambert-Beer law with the help of colorimeter and spectrophotometer.	1,2,3,8							
4	Explain biomolecule separation through thin layer chromatography.	1,2,3,8							
5	Demonstrate paper chromatography and its use in amino acids separation	1,2,3,8							

	SEMESTER – III											
Cours	se Title		Total Credits:	Entomolo	gy L	Т	P	S	R	O/F	С	
Cours	se Code	24FSZO301R	Total Hours:		2	0	0	0	0	0/1	2	
Pre-re	equisite	Nil	Co-requ		_	1 -		Ni				
Progr	amme		Bachelor of S	cience in M	Iicrob	oiolog	gy					
Semes	ster	Fall/ l	III semester of s	second year	r of th	ie Pro	ograi	nme				
	ourse ectives	focusing on Class In 2. Explore the morphol 3. Analyze the life cyc impact on human he 4. Investigate insect co	<ol> <li>Understand the classification, morphology, and key characteristics of insects, focusing on Class Insecta.</li> <li>Explore the morphology and adaptations of insect mouthparts, antenna, and legs.</li> <li>Analyze the life cycles and control measures of medically important pests and their impact on human health.</li> <li>Investigate insect communication methods and behaviors, including their role in pest management and forensic science applications.</li> </ol>									
C	CO1	Understand the overvie	w of Class Insec	ets different	morp	holog	gical	modi	ficati	ons.		
C	CO2	Able to explain the life	cycle and contro	ol measures	of pe	st of	medi	cal in	nport	ance.		
	CO3	Able to explain, illus	trate different	communica	ting t	echni	iques	and	inse	ct bel	navior	
C	CO4	Able to explain, illust controlling insect pests.						stra	tegy	adopte	ed for	
	CO5	Gain knowledge on diff	terent insects of		_							
Unit No.		Content		Contact Hour		Lear	ning	Outc	ome		KL	
I	Class Ir Insect n modific	nection to Entomology: Onesecta, its classification and norphology: Overview are ations of mouthparts, and	nd characters. nd tenna and legs.	5	Desc class morp	its liariti	es.	1,2				
II	control aegypti, Phlebot Cordylo damnos	medical importance: Li measures of Musca dome Culex quinquefasciatus, comus spp, Glossina fusci obia anthropophaga, Sim um, Pulex irritans, Cime a infestans, Pediculus hu	estica, Aedes Anopheles, ipes, ulium x lectularius,	7	7 Describe, illustrate and explain the life cycle and control measures of pest of medical importance.						1,2	
III	commucommucommucommucommucommucommucomm	communication: Chemical nication, Audio and tactile nication, Visual communication, scent insects  Behavior: Chemotropism, tropism, Phototropism, tropism, Phototropism, thermotropism otropism.  Communication:  Chemical explain the process of different communication techniques and insect behavior adopted by instropism.						of ating at		1,2		
IV	about cl insect's	insects in pest manager nemical and biological co- pest, insects in forensic science	ontrol of	5	expla mana adop	eribe, ain th agemented for the ted for	e diffent store	erent rateg	y y		1,2	
V	Life cyc	nction to Applied Enton cle, by product and comn ing of honey bee, silkwon	nercial method	7	7 Describe, illustrate and explain about different insects of economic importance.							

- 1. Insect pest management by Dent D R, (latest edition). Westville Publishing House: Delhi
- 2. An ecological and social approach to biological control, Eilenberg J, (latest edition). Springer.
- 3. Theory and Practice of Animal Taxonomy and Biodiversity by Kapoor V C 8Ed. Oxford and IBH publishing.
- 4. The insects: structure and functions by R. F. Chapman (5th Edition). Cambridge University Press.
- 5. Handbook of entomology by T. V Prasad, (4th Edition). New Vishal Publications.

#### **REFERENCE BOOKS:**

- 1. Principles of Animal Taxonomy by G. G. Simpson, (latest edition). Scientific publisher Animal Taxonomy by H. E. Goto (latest Edition). Arnold
- 2. International Code of Zoological Nomenclature official publication
- 3. A Text Book of Fundamental and Applied Entomology by M.S. Ali, S.V.S. Raju and M. Raghuraman Tanweer Alam, (latest edition). Kalyani publisher
- 4. Introduction to general and applied entomology (Scientific Pub.: India) by Awasthi V B (latest Edition). Scientific publisher's journal Dept.

#### **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Understand the overview of Class Insects different morphological modifications.	1,2,8						
2	Able to explain the life cycle and control measures of pest of medical importance.	1,2,8						
3	Able to explain, illustrate different communicating techniques and insect behaviour adopted by insects.	1,2,3						
4	Able to explain, illustrate and implement different management strategy adopted for controlling insect pests.	1,2,3,7,8						
5	Gain knowledge on different insects of economic importance.	1,2,3,7,8						

SEMESTER – III													
Cours	e Title			Foresti	ry							_	
Cours	se Code	24FSBO301R	Total credi Total hours			<u>L</u>	T 0	P 0	<u>S</u>	R 0	0/F 0	C 2	
Pre-re	equisite	Nil		requisite			U	U	Ni				
	amme		Bachelor of		Micr	obio	logy	,					
Semes		Fall/ III semester of second year of the Programme											
	ourse ectives	<ol> <li>This course aims to educate student on concepts of forestry</li> <li>Basic knowledge of forest dendrology, forest types</li> <li>The course further deals with physiology of forest, forest management and forest pathology.</li> </ol>											
(	C <b>O1</b>	Articulate the history an	d basic conce	ept of Fores	stry.								
(	CO2	Importance of Dendrolo	gy and know	ledge of wo	ood fo	rest							
(	CO3	Understanding of forest	types and for	rest manage	ement								
(	CO4	Importance of physiolog	y in forestry										
	CO5	Understanding the forest	t pathology, o	causes of fo	rest d	iseas	es						
Unit No.		Content		Contact Hour		Lea	rnin	ıg O	utco	me		KL	
I I	Introduc	ction Forestry: History o	f forestry.	5	Desc	cribe	and	exp	lain I	Histo	orv.	1,2	
II	forest typ policies in Forest in of forest managem  Dendrol scope of morpholoflora  Ecotourie	ation of forest, Basic conducts of India. Important accrelated to Indian Forest.  nanagement: Definition a management, principle of ment and their applications ogy: Introduction, import dendrology. Role of vege ogy in identification of works.  ism: Definition and elements, Principles and objectives.	and scope f forest ance and tative body forest ents of ves of	7	Describe, illustrate and explain Importance, scope and morphology of woody forest and Ecotourism							1,2	
III	Plant Ph physiolo forest tre canopies	nysiology: Introduction to gy, Photosynthesis. Water test, transpiration from force, environmental effects or elopment.	tree r relation of est	6	Desc expl phys fores	ain Ii iolog	npo	rtano	e of	tree		1,2	
IV	of India, compone cycling, measurer	Forest Ecosystem-abiotic ents and their interaction, forest management. Consment of diversity, diversity of conservation.	and biotic Nutrient ervation	5	Describe, illustrate and explain Importance of forest ecosystem, biotic and abiotic components and forest management and ecotourism.						of forest d abiotic est		
V	patholog causes of patholog	<b>rathology:</b> Importance of y. Principles of forest path of forest diseases-Physiological, general symptoms of control of forest diseases, ne.	hology, gical and forest tree	7	Desc expl path disea	ain P olog	rinc y cau	iple ises	of fo of fo	rest rest		1,2	

- 1. Agarwal, W.P. Forests in India. Oxford and I.B.H
- 2. Arvind Kumar. Biodiversity and environment. A.P.M. Publishing Corporation, New Delhi.
- 3. Kumar and Asija. Biodiversity Principles and conservation. Updesh Purohit, Agrobios, Jodhpur

#### **REFERENCE BOOKS:**

- 1. Raghavendra AS. 1991. Physiology of Trees.
- 2. John Wiley & Sons. Taiz, L. and Zeiger, E. 2007. Plant Physiology 4 th Ed. Sinauer Associates Inc. Publishers, Sunderland.

#### **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Articulate the history and basic concept of Forestry.	1,2,4,6,8							
2	Importance of Dendrology and knowledge of wood forest	1,2,3,4,8							
3	Understanding of forest types and forest management	1,2,3,4,6,8							
4	Importance of physiology in forestry	1,2,4,6,8							
5	Understanding the forest pathology, causes of forest diseases	1,2,3,4,6,8							

	SE	MESTER – III										
<b>Course Title</b>	Co-	Curricular Activ	ities									
Course code	24UBCC211R	Total Credits: 1 Total Hours: 60		L 0	T 0	P 0	S 4	R 0	O/F 0	C 1		
Pre-requisite	Nil	Co-requi	isite	Nil								
Programme		Bachelor of Scien	nce in Mic	robiol	ogy							
Semester		semester of seco										
Course Objectives	<ol> <li>Develop students' interpersonal skills, emotional intelligence, and teamwork abilities through participation in diverse co-curricular activities.</li> <li>Foster leadership qualities and organizational skills by providing opportunities for students to take on leadership roles and manage events or projects within co-curricular activities.</li> </ol>											
CO1	Improve Interpersonal a others and communicate	better.										
CO2	Develop Time Manager their time and stay organ	nized.										
CO3	Boost Creativity and Cr and think more critically	•										
CO4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.											
CO5		Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.										
Unit	Content		Contact	Le	. ]	KL						
No.	4 1 2 4		Hour	D	<u>,</u>	. ,.				1.0		
interpers time man boosting promotin encourage engagen activities with the social ar professic students participa journals worksho students commun organize	alth, and nd civic egular club tions that align stering their Renowned ops to enhance	60	By pa sport currid activity unive will of ment team. They mana pract throu renov and b while grow prom award and I encoupursu devel cultivity that e	s, mucular ities ersity devel al ag work will gem ical h gh woned wild e fost th. Toote coeness if elop in uraging the the lop in vate post to the transition of the transitio	offee cluid op prility op prility op prility op prility op prility op prility op provide on the second of the seco	and tred t bs, s shysis, lead created to the shop of the state of the shape of the	hrou tuden ical a dershe ativite time is with ional ivitie vity, ing, ents to sts, s, and d the	gh ints and hip, ty. e. hh ss, ace hil ss	1,2			

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Improve Interpersonal and Teamwork Skills- Students will learn to work well with others and communicate better.	6,7							
2	Develop Time Management and Organizational Skills - Students will learn to manage their time and stay organized.	6,7							
3	Boost Creativity and Critical Thinking - Students will enhance their creative abilities and think more critically.	6,7							
4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.	6,7							
5	Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.	5,6,7							

	SEMESTER – IV											
Cours	se Title		Molecula	ar Biology	and RDT	1						
Cours	se code	24BSMB221R	Total cre		L	T	P	S	R	O/F	C	
Pre-r	equisite	Nil		ırs: 45T+3 -requisite	30P 3	0	2	0 N	<u>0</u> Vil	0	4	
	amme	l l		cience in N	Microbiol	nov		1,	111			
Seme							aran	nme				
Seme	Ste1		Spring/ IV semester of second year of the Programme ach kea topics like DNA structure, central dogma, modifications in RNA and									
	ourse ectives	proteins, DNA repair and recombination.  2. To make students aware of various molecular biology techniques.  3. To make students understand the key topics like cloning, vectors, DNA sequencing, Genome mapping  4. To make students understand the application of RDT										
	CO1	Describe the role of DNA as	s genetic m	naterial its	renlicatio	n and	d tra	nscr	intic	nn .		
	CO2	Explore the bacterial Reco	ombination	process v	with unde	rstar	nding		•		repair	
(	CO3	Summarize various restriction	on enzyme	s, vectors a	and their u	se ir	ı RD	T				
	CO4	Applying the DNA amplific	ation techi	niques in p	ractical sc	enar	ios					
(	CO5	Describe the various gene		chniques a	and recom	bina	nt I	NA	tec	hnolog	gy for	
Unit	1	producing pharmaceutical pharmaceutical producing pharmaceutical pharmaceuti	roteins.	Contact	Lear	nina	Ο	taan	•	1 1	KL	
No.		Content		Hour	Lear	unig	Ou	tcon	16	'	KL	
I	DNA as RNAs a the carr Chromo Central Enzyme replicat transcrip	lar biology an overview: Disco is genetic material, Structure of and their structure & function, ier of genetic information, osomes, chromatin and function Dogma. Eukaryotic DNA Rep is and proteins involved in It ion. Eukaryotic Transcription, ptional modifications Eukaryotion, post translational modifications	DNA, DNA as  n, The dication: DNA post tic	12	Describe DNA str replication and transeukaryot	uctu on. T slatio	re, Frans	scrip			1,2	
П	model) DNA re excision Basic M a. Isolat DNA b. Agarc c. South d. North	pination: Homologous (Hollida and non-homologous recombination: Base excision repair, nuch repair; Mismatch repair, SOS folecular Biology Techniques aion of plasmid DNA, chromostose gel Electrophoresis aern blot mern blot ern blotting	nation eleotide repair.	7	Describe explain l recombin molecula technique isolation	Procenation ar bid es fo	ess on, boolings ologion Di	of asic y NA			1,2	
Ш	enzyme enzyme polymer transfer enzyme bacterio	w Gene cloning tools - Restricts - class I, II and class III restricts, and their features. Ligases, rases, alkaline phosphatases, kases and other DNA engineerings. Vectors - Plasmid vectors, ophage, cosmids and phagemidation vectors, shuttle vectors	ction inases, ng	7	Describe explain t for gene applicati	he d	iffer	ent 1	tools	s	1,2	
IV	DNA at	mplification through PCR: Bas and applications of PCR, type		8	Describe explain t process	he p	rinci	ciple and				

	DNA sequencing techniques: Maxam – Gilbert's method, Sanger's dideoxy chain termination method, Automated DNA sequencing. Genome Mapping: Concept and applications. Restriction enzymedigestion and restriction mapping. Dot blots and slot blots. RFLP, RAPD, microarray		Sequencing process, Genome mapping and localization of a gene.	
V	Gene transfer: Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser and Agrobacterium mediated gene transfer, Applications of Recombinant DNA technology: Production of recombinant proteins of pharmaceutical importance- insulin, human growth hormone, recombinant Vaccines (hepatitis B) etc. Transgenic plants and animals	11	Describe, illustrate and explain the gene transfer mechanism and application of RDT in production of recombinant proteins, transgenic animals and plants.	1,2
Practical	<ol> <li>Demonstration of PCR</li> <li>Demonstration of centrifuge</li> <li>Demonstration of spectrophotometer</li> <li>Isolation of Plasmid DNA, chromosomal DNA, Eukaryotic DNA, Study of Plasmid Vector</li> <li>Competent cell preparation, Blue and white screening, Restriction digestion, Electrophoresis</li> <li>Replica Plating Technique</li> </ol>	30	Proficiency in DNA isolation and separation techniques. Transformation technique and screening	1,2,3,4

- 1. Alberts, B., et al. Molecular Biology of the Cell, Garland, 4th ed., 2002
- 2. Lodish, H., et al. Molecular Cell Biology, WH Freeman, 2003.
- 3. Essentials of Molecular Biology by David Freifelder, 2009
- 4. Molecular Biology of gene, James d. Watson, Alexander gann, Tania a. Baker, Michael levine, Stephen p. Bell, Richard losick, Cold spring harbor laboratory press
- 5. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
- 6. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
- 7. Willey JM, Sherwood LM, and Woolverton CJ. (2008) Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

#### **REFERENCE BOOKS:**

- 1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc
- 2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- 3. Basic Methods in Molecular Biology by Davis et al. 2007(Elsevier)
- 4. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.
- 5. Glick BR and Pasternak JJ. (2003). Molecular Biotechnology. 3rd edition. ASM Press Washington D.C.
- 6. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

7. Alcamo IE. (2001). DNA Technology: The Awesome Skill. 2nd edition. Elsevier Academic Press, USA.

## **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the role of DNA as genetic material, its replication and transcription	1,3,8							
2	Explore the bacterial Recombination process with understanding their DNA repair mechanisms and applying the basic molecular biology techniques	1,2,3,4,8							
3	Summarize various restriction enzymes, vectors and their use in RDT	1,3,6,8							
4	Applying the DNA amplification techniques in practical scenarios	1,3,4,8							
5	Describe the various gene transfer techniques and recombinant DNA technology for producing pharmaceutical proteins.	1,2,3,6,8							

			SEMESTER	R – IV									
Cour	se Title		Biop	physical Cl	hemistry	7							
Cour	se Code	24BSMB222R	Total credi			L ]	_	_					
			Total hours			2 (	) (			0	2		
	equisite	Nil	Nil Co-requisite Nil  Bachelor of Science in Microbiology										
	ramme												
Seme	ster	Spring/ IV semester of second year of the Programme  1. Understand pH, buffer systems, and the properties of water, including buffering											
Course Objectives		<ol> <li>action and capacity, and the Henderson-Hasselbalch equation.</li> <li>Explore quantum mechanics concepts, including atomic structure, black body radiation, Planck's law, photoelectric effect, and hybridization.</li> <li>Analyze chemical bonding types such as ionic, covalent, hydrogen bonds, peptidyl bonds, and van der Waals forces.</li> <li>Comprehend the principles of thermodynamics, including the laws of thermodynamics and their significance in biological systems, and the concepts of protein folding and cell membrane biophysics.</li> </ol>											
(	C <b>O</b> 1	Explain the concepts of pH, buffers and related theories.											
(	C <b>O2</b>	Explain quantum mechanics and the laws associated with it.											
	C <b>O3</b>	Illustrate the different type	s of bonding	g in molecu	lar intera	actic	n						
_	C <b>O4</b>	Outline the laws of thermo	dynamics.										
	C <b>O</b> 5	Explain the mechanism of	protein fold										
Unit No.		Content		Contact Hour	L	earı	ing	Out	come	;	KL		
I	theory; l	uffer: Introduction; Bronsted Lewis theory; Buffering action; H-H equation; Biological es of water	on; Buffer	7	7 Describe, illustrate and explain pH, buffers and related theories								
II	of atomi Plank's	n mechanics: Atomic structuc c orbital); Black body radiat law; Photoelectric effect; zation structure of atom.		6	Describe explain and the it.	qua	ıntur	n me	echan		1,2		
III		al bonding: Ionic, Covalent, eptidyl bond; Vander Waal f	, .	5	Describ different for inte	nt bo	ondii	ig ar	nd for		1,2		
IV	internal enthalpy	dynamics: First law (concept energy); Second law (free en y, entropy); free energy in bio 3rd law; Significance and lin	nergy, ological	7	Describe explain the law	1				nics	1,2		
V	hydroph	s of protein folding: (Amino ilic & hydrophobic propertie ics of cell membranes.		5	and sm o	f	1,2						

1. Allen J. P. Biophysical chemistry. 1st Edition. Wiley-Blackwell; 2009.

#### **REFERENCE BOOKS:**

- 1. Cantor and Schimmel. Biophysical Chemistry. 1st Ed., W.H. Freeman 6 Co., San Francisco; 1980.
- 2. Holde, Johnson and Ho. Principles of Physical Biochemistry. 2ndEd.. Pearson Prentice Hall; 2005.
- 3. S. E. Harding and Chowdhry. Protein-Ligand Interactions: Hydrodynamics and Calorimetry: A Practical Approach. 1st Ed. OUP Oxford; 2000.

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the concepts of pH, buffers and related theories.	1,2,3,8						
2	Explain quantum mechanics and the laws associated with it.	1,2,3,8						
3	Illustrate the different types of bonding in molecular interaction	1,2,3,6,8						
4	Outline the laws of thermodynamics.	1,2,3,4,6,8						
5	Explain the mechanism of protein folding.	1,2,3,6,8						

	SEMESTER – IV												
Cours	se Title			Bioinform	atics								
Cours	se Code	24BSMB223R	Total cred		0P	<u>L</u>	T 0	P 2	<b>S 0</b>	R 0	0/F 0	<u>C</u>	
Pre-r	equisite	Nil	Co-	-requisite					N	il			
Progr	amme	Ba	achelor of S	science in 1	Microb	iolo	gy						
Seme	ster	Spring/ IV semester of second year of the Programme											
	ourse jectives	<ol> <li>To give basic computer knowledge and their practical application.</li> <li>Knowledge on computational database management system and its application in Biology</li> <li>A basic idea on the structural biology using computer.</li> </ol>											
•	C <b>O</b> 1	Explain the basics of canalysis	computer as	nd its app	lication	ıs iı	n B	iolo	gy,	including data			
(	C <b>O2</b>	Explain the basis and app	lications of	internet in	biolog	y.							
(	C <b>O3</b>	Inculcate the foundation of	of database	manageme	nt								
	C <b>O</b> 4	To impart knowledge on	various mol	ecular sequ	ience a	nd s	truc	ture	data	ıbas	es		
-	C <b>O</b> 5	Develop skills in using bi											
Unit No.		Content	Official	Contact Hour					tcon			KL	
I	Computer	Fundamentals- History of		5	Descr	ihe	and	exn	lain		1	1,2	
II	computers, Generations and Classification of computers, Hardware and Software concepts, Block Diagram of Digital Computer, Limitations and Capabilities of computers, I/O devices, Storage devices, RAM ROM, Memory unit- primary and Auxiliary.  Introduction to MS office Tools- MS Word-Introduction, starting MS Word, Standard menus—file, edit, view, formatting a text, layouts, inserting a diagram, graph, page numbers, borders, bullet & numbering, spelling			5	Describe, illustrate and explain use of MS office tools in Biology, networking, multimedia and its uses				1	1,2			
	tables and PowerPoi Internet a Important Electronic Web Page Multimed Compone	d grammar, letter and mailing, mail merge, bles and its applications. MS Excel and MS owerPoint.  ternet and Networking - Introduction, aportance, Network– LAN, MAN, WAN, ectronic Mailing, Chatting, Search Engine, leb Pages, Virus, Antivirus, Malware, ultimedia- Introduction, Applications, components and its Uses.											
Ш	Introducti (DBMS)	management system (DBM on to database management and its different types.	system	5	Descr explain databa applic	in fo ase a catio	ormand and on in	ition its bio	of a		1	1,2	
IV	generation relation w related too RASMOI PDB) and MMDB v Bioinforn Bioinforn	on to bioinformatics and da n- What is bioinformatics are with molecular biology. Exar- ols (FASTA, BLAST, BLA- L), databases (GENBANK, I d visualization software (RA- iewer, MolMol etc). Applications, Pharmaceutical comp- natics. Flat file formats. Profe- ty modelling, physiochemical	nd its mples of  I, Pubmed, SMOL, ations of panies and tein	7	Descr expla its rel biolog	in bi	ioin: n wi	form th n	natic noled	s an cula	d r	1,2	

	calculation, introduction to different literature database			
V	Biological Database and its Types- General Introduction of Biological Databases: Nucleotide sequence databases (NCBI, DDBJ and EMBL). Protein sequence databases (SWISS-PROT, PIR, Gen Pept), Specialized Genome databases: (SGD, TIGR etc.). Structure databases (CATH, SCOP, and PDB, NDB, MMDB), introduction to cheminformatics, immunoinformatics, pharmacoinformatics,	8	Describe, illustrate and explain the various biological databases, including nucleotide, protein, genome, and structure databases, and an introduction to cheminformatics, immunoinformatics, and pharmacoinformatics.	1,2
Practical	<ol> <li>Base sequence analysis of gene/ protein sequence.</li> <li>Computer aided survey of scientific literature.</li> <li>Computer aided visualization of amino acid sequence of protein and its 3D structure.</li> <li>To identify various protein parameters of a protein.</li> <li>To perform nucleotide sequence alignment using BLAST of a given sequence.</li> <li>To perform protein sequence alignment using BLAST of a given sequence.</li> <li>To Perform Homology Modelling of Protein using SWISS-MODEL</li> <li>To Perform Homology Modelling of Unknown Structure of Protein Using Geno 3d.</li> <li>Various analysis of DNA and protein sequences through EMBL, SCF Bio Tool box</li> </ol>	30	Proficiency in retrieving the information as well as the use of different tools and server for solving different biological problems	1,2,3,4

- 1. Fundamental of Bioinformatics: Harisha S.
- 2. Instant Notes: Bioinformatics. DR Westhead, JH Parish, RM Twyman. BIOS Scientific Publishers, Oxford, 2002.

#### **REFERENCE BOOKS:**

- 1. Genome Analysis and Bioinformatics: A Practical Approach (English) (Paperback) by T. R. Sharma, I K International Publishing House
- 2. Bioinformatics: Genes, proteins and computers. C.A. Orengo, D.T. Jones and J.M. Thornton
- 3. Introduction to Bioinformatics: T.K. Attwood, D.J. Parry-Smith and S. Phukan

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the basics of computer and its applications in Biology, including data analysis	1,3						
2	Explain the basis and applications of internet in biology.	1,3						
3	Inculcate the foundation of database management	3						
4	To impart knowledge on various molecular sequence and structure databases	1,3						
5	Develop skills in using bioinformatics tools for sequence alignment and analysis.	1,3,8						

	SEMESTER – IV												
Cours	se Title		Food Micr	obiology	V								
Cours	se Code	24BSMB224R	Total credits: 4		L	T	P	S	R	O/F	C		
			Total hours: 45T+		3	0	2	0	0	0	4		
	equisite	Nil	Co-requisite					Ni	l				
	amme		achelor of Science in										
Seme	ster		semester of second				_						
	ourse ectives	<ol> <li>To teach students the microbial ecology of foods and the ecological factors that affect the presence, survival, growth and death of microorganisms in food.</li> <li>To teach students about the principles of food preservation techniques</li> <li>To teach students about the microbiology of various food and dairy products and the pathogenesis of the food borne and water borne diseases.</li> </ol>											
	101	Understanding the vari					ent	food	ls ty	ypes	and		
	CO1	comprehending the fundamental principles of microbial spoilage in food.											
	01	Remembering the various principles underlying physical and chemical methods of											
	<b>O2</b>	food preservation with the Application of Preservation Technique											
		Determine the basic composition of milk and its nutritional components with the											
C	O3	factors influencing the qu	*	_	_						n in		
		milk and examining the fe											
C	<b>O</b> 4	_	Remembering the various food borne diseases with their causative agents and										
		preventive measures.											
C	<b>O</b> 5	Analysis the various De				ples	and	und	ersta	nding	the		
	I	Membrane Filter Techniq				_					T 7 T		
Unit No.		Content	•	Contact Hour		Lea	rnin	g Ou	tcon	ne	KL		
I	Introdu	ction To Food Microbiology	: Natural flora	9	D	escr	ibe a	nd ex	olai	n	1,2		
	and Sou	arces of contamination of foo	ods in general.		the general microbes					s			
		ial spoilage: principles, intri			present in foods and the				I				
		that affect growth and survive poilage of vegetables, fruits,			factors that support the growth and spoilage of								
		canned foods.	illeat, eggs,		various food products								
II		les and methods of food pres	servation:	9	_			llusti			1,2		
	Princip	les, physical methods of food	d preservation:					prin					
		nperature, High temperature						ds of		I			
		Canning; Irradiation; Chemeservation: salt, sugar, organ			preservation technique				ue				
	antibiot		ne acius, 502 anu										
III		microbes in milk and dairy	products:	9	D	escr	ibe, i	llustı	ate a	ınd	1,2		
	Compos	sition of milk, Sources, cont	amination and		ex	kplai	n the	com	posi	tion			
	1 0	e of milk and milk products, cological analysis of milk. Fe	~ I					e sou					
			ter, buttermilk,					non c rodu		IK			
	curd	o i ormonica cheese,	ver, cuttermin,					crobi		ical			
					ar	nalys	sis of	milk	and				
								dairy	,				
					pı	rodu	cts						
IV		orne Diseases- Definition of		9 Describe, illustrate and explain the various						1,2			
		fections and toxication. Caus											
		nvolved, symptoms and prevatoxications: Staphylococcus					oi io es, tl	od bo neir	orne				
		dium botulinum and mycotox					genes						
			reus, Escherichia				oms,						
		igella, Listeria monocytoger	nes, Salmonella,		pı	rever	ntion						
	Cholero	ı											

V	Treatment and safety of drinking (potable) water: methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique	9	Describe, illustrate and explain the methods to detect portability of water samples.	1,2
Practical	<ol> <li>MBRT of milk samples and their standard plate count.</li> <li>Isolation of food borne bacteria and fungi from food products.</li> <li>Most Probable Number Analysis</li> <li>Microbiological examination of canned foods.</li> <li>Isolation of spoilage bacteria from fruits and vegetables.</li> <li>Adulterant test: formalin and starch test</li> <li>Effect of temperature on the spoilage of food products.</li> <li>Production of fermented food and their microbial examination</li> </ol>	30	Proficiency in various tests to determine the quality of milk, water and food products	1, 2, 3, 4

- 1. Frazier W.C. and Westhoff D.C. (2008) Food Microbiology, 4th Edn. Tata McGraw Hill Publishing Co., New Delhi.
- 2. Bamforth C.W. (2005) Food, Fermentation and Microorganisms, Blackwell Science.

#### **REFERENCE BOOKS:**

- 1. Doyle M.P. and Buchanan R.L. (Ed.) (2013) Food Microbiology: Fundamentals and Frontiers, 4th Edn. ASM press.
- 2. Jay J.M., Loessner M.J. and Golden D.A. (2005) Modern Food Microbiology, 7th Edn. Springer Publishers.
- 3. Robinson R.K. (2002) Dairy Microbiology: Milk and Milk Products, 3rd Edn. Wiley Publishers

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Understanding the various natural microflora in different foods types and comprehending the fundamental principles of microbial spoilage in food.	1,2,4,8						
2	Remembering the various principles underlying physical and chemical methods of food preservation with the Application of Preservation Technique	1,2,3,4,8						
3	Determine the basic composition of milk and its nutritional components with the factors influencing the quality of milk and Recognizing sources of contamination in milk and examining the fermentation processes of cheese, butter, and buttermilk.	1,2,3,4,8						
4	Remembering the various food borne diseases with their causative agents and preventive measures.	1,2,3,4,6,8						
5	Analysis the various Detection Methods of water samples and understanding the Membrane Filter Technique and Hands-On Competence.	1,2,3,4,6,7,8						

		SEME	STER – IV									
Cour	se Title		<u> Iicrobial Culture</u>	Techniq	ques		ı					
Cour	se code	7/125//12//31	Total credits: 1 Total hours: 30l	L	$\begin{array}{c c} L & T \\ \hline 0 & 0 \end{array}$	P 2	S 0	R	0/F 0	<u>C</u>		
Pre-r	equisite	Nil	Co-requisit		U   U	<u> </u>	v	lil	U	1		
	ramme	-	or of Science in N		logy							
Seme		Spring/ IV seme				ram	me					
		1. Develop proficiency in aseptic techniques for handling microorganisms safely and										
		preventing contamination in n	nicrobial cultures	•								
		2. Acquire skills in culturing and isolating diverse microorganisms from natural										
	ourse	environments, clinical samples, and industrial sources.										
Obj	jectives	3. Understand the principles of microbial growth kinetics and physiology by										
		monitoring growth parameters such as optical density, colony-forming units,										
		biomass, and metabolic activity using spectrophotometry, viable cell counts, and										
		biochemical assays.										
(	C <b>O</b> 1	Proficient in aseptic techniques	to prevent contar	nination.								
	CO2	Ability to prepare diverse cultur	re media for micro	obial grov	wth.							
	CO3	Competence in isolating and ide	entifying microor	ganisms ı	ısing	vari	ous t	echni	iques.			
(	C <b>O</b> 4	Understanding of culture mainte	enance principles	and prese	ervati	on n	netho	ods.				
	C <b>O</b> 5	Develop critical analysis skills a	alysis skills and troubleshoot common issues in microbial cultures.									
Unit No.		Content	Contact Hour	Leai	ie	K	L					
I	Preparati	and Fungal Culture Techniques: ion of liquid, semi solid and solid lates and slants).	7									
II	Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  5				ncy in		ious	ł	1,2,	, 3,		
Ш		g in basal media, differential medi media and enriched media.	a, 5	techniques for bacterial and fungal identification.						4, 5		
IV	Interpre different	tation of colony characteristics on media.	7									
V		on of growth parameters: ture, PH, nutrients.	6									

- 1. Experiments in microbiology, brand petrology, tissue culture, and microbial biotechnology by KR Aneja, New Age international publication.
- 2. Benson's Microbiological Applications Laboratory Manual in General Microbiology by Alfred Brown and Auburn University Heidi Smith, McGraw-Hill Education.
- 3. Handbook of MICROBIOLOGICAL MEDIA, Ronald M. Atlas, ASM press

## **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

https://www.youtube.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Proficient in aseptic techniques to prevent contamination.	1,2,3,6,8					
2	Ability to prepare diverse culture media for microbial growth.	1,2,3,4,6,8					
3	Competence in isolating and identifying microorganisms using various techniques.	1,2,3,6,7,8					
4	Understanding of culture maintenance principles and preservation methods.	1,2,3,4,6,8					
5	Develop critical analysis skills and troubleshoot common issues in microbial cultures.	1,2,3,6,8					

		SEN	MESTER – IV								
Cours	se Title		English for Empl								
Cours	se code	1 741182117778	Total credits: 2 Total hours: 32	L		P 2	<u>S</u>	R	O/F 0	C 2	
Dro r	equisite	Nil	Co-requisi	0	U	<u> </u>	U Ni		U	<u> </u>	
	amme		elor of Science in		<b>TV</b>		111	11			
Seme			mester of second			mn	10				
Scinc	3101	1 2		•				ınde	retand	ling	
		1. To develop public speaking skills, including script preparation, understanding nonverbal cues, overcoming fear, and practicing speaking strategies.									
		2. To provide practical experi			_			res	iimes :	and	
		cover letters.	ence in preparing	, saoimumg, a	ilia sc.	i CC	1111112	, 103	unics	ana	
	ourse	3. To teach email etiquette, including the structure of emails and effective drafting									
Obj	ectives										
		_	techniques.								
		4. To prepare students for interviews through practice with commonly asked questions and mock interview sessions.									
				ita dafinitian	<b>t</b>	0.40	.d .f	Fact.	~		
		5. To introduce conflict manage Enable students to prepare	<u> </u>							or 1	
(	CO1	1 1	* '	u nonverbal (	cues,	OVE	erco	ше	iear, a	ana	
practice public speaking strategies.											
	Equip students with skills to prepare, submit, and screen resumes and cover letters.  Teach students the different parts of an email and effective email drafting techniques.										
	CO3	_									
(	CO4	Prepare students for intervious		eing common	ly as	kec	d q	uest	ions a	and	
		participating in mock intervie Students will understand the		rt managemer	ıt ide	ntif	v di	ffer	ent tyr	nes	
C	CO5	and analyze its effects.	concept of confin	et managemen	ii, iuc	11111	y ui	iiici	ciii typ	jes,	
Unit		Content	Contact	Learni	ng Oı	ıtco	ome	!	K	ΚL	
No.	D-1.1.	C 12 C1211.	Hour								
1		Speaking Skills ration of Scripts and understand	· ·	effective spe					3	, 4	
		verbal cues of Public Speaking	anig		nonverbal cues,						
		erstanding and Overcoming Fear	r of	manage publ							
	Publ	ic Speaking		anxiety, and				ctive	e		
	ii. Pract	ice strategies of Public Speaking	g	speaking tec	hniqu	es.					
II	Practic	al session on Resume and Cov	er 5	Students wil	,	3					
	letter			and evaluate		nes	and	l			
	Prepa     Resur	ration, submission & screening	of	cover letters							
		ne. ical session on cover letter scree	enina								
	sessio										
III		Etiquettes	5	Students wil	l unda	ret	and	the	1 2	, 3	
111		erent Parts of Email and Usage		structure of						, ,	
		ting emails effectively		them effective							
IV	Intervio	w Skills (Mock sessions)	7	Students wil	langr	7 <b>6</b> *	com	mar	n 2	, 5	
1 4		ring Commonly asked Interview	· ·	interview qu			COII	111101	<u> </u>	, ,	
	Quest			confidently a			rm v	well			
		x Interview sessions		in mock inte							
V	Conflic	t Management	8	Students will understand the						, 4	
•	i. Defin			concept of co							
		of Conflict Management		management			7				
	• •	cts of Conflict Management		different typ				se			
				its effects.							

- 1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writingand Speaking, Zephyros Press.
- 2. Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- 3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- 4. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

- 1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- 2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- 3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- 4. Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### OTHER LEARNING RESOURCES:

https://learning.shine.com/talenteconomy/career-help/top-group-discussionskills

https://www.coursera.org/articles/conflict-management

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and practice public speaking strategies.	2,5,8						
2	Equip students with skills to prepare, submit, and screen resumes and cover letters.	2,5,8						
3	Teach students the different parts of an email and effective email drafting techniques.	2,5,6,8						
4	Prepare students for interviews by practicing commonly asked questions and participating in mock interview sessions.	2,5,8						
5	Students will understand the concept of conflict management, identify different types, and analyse its effects.	2,6,7,8						

	SEMESTER – IV												
Cours	se Title		Basic Ac	eclimatizin	g Skills	(BAS	<b>S</b> )						
Cours	se Code	24UULS201R	Total Credits Total Hours:		L 0	T 0	P 2	S	R	O/F 0	C 2		
Pre-re	equisite	Nil	Co-rec			U		Nil	U	U	<u> </u>		
	amme	Bachelor of Science in Microbiology											
Semes	ster	Spring/ IV semester of second year of the Programme											
	ourse jectives	<ol> <li>To impart knowledge of the fundamentals of Hospitality industry and its applications.</li> <li>Students will be able to familiarize with the cooking equipment &amp; Utensils.</li> <li>Students will be able to handle different modes of reservations.</li> </ol>											
(	C <b>O</b> 1	Students will have basic knowledge of cooking methods.											
	C <b>O2</b>	Students will gain the k					Rooi	ms.					
	C <b>O3</b>												
	C <b>O</b> 4	Students will be able to gain the travel management concept.  Students will be able to acquire the knowledge of basic household's amenities for day-to-day use.											
Unit No.		Content		Contact Hour	Lo	earni	ng O	utcoi	me	]	KL		
I	Manage  • (	ction to Accommodation ment Telephone handling techn Organizing of Rooms. Cleaning agents. Cleaning equipment's and Bed making Process.	nique	8	Develop the ability to hand telephonic communication, organize rooms, utilize cleaning agents and equipment effectively, and perform bed-making processes.					3, 4			
II	• I • I • I	nentals of Cooking Definition of cookery –A Objectives of cooking. Use of basic cooking equ Personal Hygiene and Sas Use of Fire & Fuels	ipment's	7	Understand the objectives of cooking, use basic cooking equipment, and maintain personal hygiene and safety in the kitchen.						3		
III	• I	s of Cooking Different Cuts. Use of Herbs and Spices. Basic Food and Beverage  ☐ Regional food Habits.	e Preparation.	7	Acquire knowledge of food preparation techniques, different cuts, herbs and spices, and regional food habits.				1 2	2, 3			
IV	• ( • I • I	& Format's C –form Reservation form Registration form Passport Application forn Legal Rent Agreement	n	8	Gain p comple essenti reserva forms, docum agreen applica	eting a al for ation to C-for ents lents	and ums so forms rms, a ike re and p	indersuch as s, regand le	s istrat egal	ing	3, 5		

- 1. Arora K (2011). Theory of cookery, Frank brothers & company (pub) pvt ltd-New Delhi.
- 2. Bruce H. Axler, Carol A. Litrides (2010) Food and Beverage Service Volume 1 of Wiley Professional Restauranteur, Guides.
- 3. Mohammed Zulfikar (2010) Introductions to Tourism and Hotel Industry Introduction to Tourism and Hotel Industry. Vikas Publishing.

4. Sudhir Andrews (2013) Food and Beverage Service: A Training Manual, Tata McGraw Hill, 2013.

S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Students will have basic knowledge of cooking methods.	1,3,4,8
2	Students will gain the knowledge of organizing & Cleaning of Rooms.	3,4,6,7
3	Students will be able to gain the travel management concept.	2,4,6,7
4	Students will be able to acquire the knowledge of basic household's amenities for day-to-day use.	1,3,4,8

<u>C</u>	SEMESTER – IV Course Title Basic Digital Literacy									
Cours	se Title		Total credits: 1	Digital Lit	teracy T	P	S	R	O/F	С
Cours	se code	24UUDL101R	Total hours: 30	0	0	2	0	0	0	2
Pre-re	equisite	Nil	Co-requisite				Nil			
Progr	amme		Bachelor of So	cience in N	Microb	iology				
Semes	ster	Sp	ring/ IV semester of	second ye	ear of t	the Pro	gram	me		
	ourse ectives	<ol> <li>Students will be able to identify and analyses computer hardware, software and their uses.</li> <li>Students will be able to use MS-Office suite for various purposes.</li> <li>Students will be able to use the Internet efficiently for required information as well as for digital financial transactions.</li> </ol>								
C	CO1	Students will have handling.	basic understanding	of Compu	ter Har	dware	, Softv	vare ar	nd Con	nputer
С	O2	Students will be a Products.	ble to solve basic in	formation	manag	gement	issue	s using	g MS-0	Office
C	<b>CO3</b>	Students will be al	ole to efficiently searc	h the Inter	net for	requir	ed inf	ormati	on.	
Students will be able to use computing technically ethically, safely, securely a for day-to-day use.										
C	<b>CO5</b>	_	knowledge of digital and using various pay		•	n and a	icquire	pract	ıcal sk	alls in
Unit No.		Content		Contact Hour		.earnii	ng Ou	tcome		KL
I	i. Comp functi ii. Diffe	nentals of Computer conents of a Computer cons. Frent Types of Computer cations.	er and their	7	comp comp differ	ents wi conents outers a rent typ heir ap	and f and expose of	unction plore compu	ns of	3, 4
П	i. Comp ii. Creat iii. Cr Po	onents of the MS-Office ting documents with eating Presentation werPoint.	ffice suite. MS-Word. ns with MS-	5	MS-V MS-V and M docum	ents wi Office to Word, I MS-Exc ments, preads	tools, i MS-Po cel, to preser	ncludi werPo create	ng oint,	3
III	i. Int an ii. W po ii. W Int En Ke iii. Cr	croduction to Internet & croduction to Comp d Internet. orld Wide Web, Wertals, Web browsing eb Searching, Searching, Searching, Searching, Searching, Searching, How to search eywords, topics of eation and use of Inyber Crimes.	Vebsites and Webing. Such engines, the Search which using Interest, etc.	5	5 Students will acquire knowledge about compunetworks, the internet, wbrowsing, search engine and email creation, whill understanding cybercrin					2, 3
IV	i. The P social n ii. Creat	ction to Social Me cower of social medi- nedia in present scen- ting accounts and us all media portals and	a, Relevance of nario.	7	Students will explore the power and relevance of social media, create accounts on popular social media platforms, and learn proper social media					3, 5

	WhatsApp, Facebook, Twitter, Instagram,		etiquette.	
	LinkedIn.			
	iii. Social Media Etiquettes.			
V	Digital Payments  i. Introduction to Digital Payment Systems.  ii. Creating accounts and using Digital Payment Systems like Credit Cards, Debit Cards, Net banking, UPI.	6	Students will gain the ability to use digital payment systems like credit cards, debit cards, net banking, and UPI by creating and managing	2, 3
			accounts.	

- 1. Sinha Pradeep K. and Priti Sinha. *Computer Fundamentals: Concepts Systems & Applications*. 3rd ed. New Delhi: BPB Publications.
- 2. Goel, A, 2010. Computer Fundamentals, Pearson India.

#### **REFERENCE BOOKS:**

- 1. Balaguruswamy, E. 2009 Fundamentals of Computers, Tata McGraw-Hill Education.
- 2. Balaguruswamy, 2014. E. Fund Of Comp & Programming (Updated Ed Sem. I, Au) Tata McGraw-Hill Education.
- 3. Lawson, C. 2022. Introduction to Social Media, Oklahoma State University.

#### **OTHER LEARNING RESOURCES:**

- 1. https://www.w3schools.com
- 2. https://edu.gcfglobal.org
- 3. https://www.tutorialspoint.com
- 4. https://www.javatpoint.com/
- 5. Latest updates available in WWW.

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Students will have basic understanding of Computer Hardware, Software and Computer handling.	3,8					
2	Students will be able to solve basic information management issues using MS-Office Products.	2,3					
3	Students will be able to efficiently search the Internet for required information.	2,3,7,8					
4	Students will be able to use computing technically ethically, safely, securely and legally for day-to-day use.	2,3,8					
5	Students will gain knowledge of digital payment system and acquire practical skills in creating accounts and using various payment methods	2,3,6,8					

		SEME	CSTER – IV								
Cour	se Title		Forensic Bio	logy							
Cour	se code	24FSFS401R	otal credits: 3 otal hours: 45	1 3	T 0	P 0	S 0	R 0	O/F 0	C 3	
Pre-r	equisite	Nil	Co-requisite Nil								
Progr	ramme	Bachelor of Science in Microbiology									
Seme	ster	Spring/ IV semester of second year of the Programme									
Course Objectives		<ol> <li>Understand the significance and relevance of biological evidence in criminal investigations.</li> <li>Understand the importance of DNA profiling in forensic identification and its limitations.</li> <li>Learn methods for the detection and analysis of bloodstains, including presumptive and confirmatory tests.</li> </ol>									
(	C <b>O</b> 1	Acquire a foundational understan	nding of forensic b	oiology.							
(	C <b>O2</b>	Learn the principles and technique	ues of DNA analy	sis.							
(	CO3	Explore the analysis of bodily f the identification of blood group		s on blo	oods	tain	patte	rn an	alysis	and	
(	CO4			d anthropology in forensic investigations.							
(	C <b>O</b> 5	Understand the protocols and analyzing biological evidence from		lved in	coll	ectir	ng, p	reser	ving,	and	
Unit		Content	Contact	Le	<b>Learning Outcome</b>					KL	
No.	Introduc	ction to Forensic Biology: Overv	Hour 6	Under	retan	d ba	rice (	of.		1,2	
1	of forens historica	ic biology: scope, applications, and development, legal aspects and onsiderations in forensic biology		W 6 Understand basics of forensic biology						1,2	
II	Principles and Techniques of DNA Analysis:  DNA structure and function relevant to forensic applications, Techniques in DNA extraction, quantification, amplification (PCR), and analysis  Explain the principle o DNA profiling using P							1,2			
III	character saliva), b	of Bodily Fluids: Identification a rization of bodily fluids (blood, se bloodstain pattern analysis: princip, and interpretation	men,	Expla detect of boo	ion a	and i	nterp			1,2	
IV	group sy techniqu	roup Antigens and Serology: Blostems and their forensic significant es for blood group antigen testing cal analysis	nce,	Descr blood			•			1,2	
V	Investigation identification profiling estimation	Anthropology in Forensic ations: Forensic anthropology: ation of human remains and biolog, methods in skeletal analysis and on, Crime scene protocols for all evidence collection and preserval	age	Discu anthro			ic			1,2	

# **REFERENCE BOOKS:**

R1. Schober, Li, Norman; Forensic Biology; 2nd Ed.; Taylor & Francis Ltd; 2021.

R2. Mia; Sharma; Singal. Handbook of Forensic Biology & Forensic Serology; 1st Ed.; Selective & Scientific Books, 2022.

OTHER LEARNING RESOURCES: https://pubmed.ncbi.nlm.nih.gov/33809459/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Acquire a foundational understanding of forensic biology.	1,5,8					
2	Learn the principles and techniques of DNA analysis.	1,2,3,6					
3	Explore the analysis of bodily fluids, with a focus on bloodstain pattern analysis and the identification of blood group antigens.	1,2,3,4					
4	Investigate the role of entomology and anthropology in forensic investigations.	1,2,4,8					
5	Understand the protocols and procedures involved in collecting, preserving, and analysing biological evidence from crime scenes.	1,2,3,4,8					

	SEMESTER – IV											
Cours	se Title		В	asics of	Food	l Scien	ce					
Cours	se code	24FSFN401R	<b>Total Credits: 3</b>	L	T	P	S	R	O/F	C		
			Total Hours: 45	3	0	0	0	0	0	3		
	equisite	Nil	Nil Co-requisite Nil  Bachelor of Science in Microbiology									
	amme											
Semes	ster	Spring/ IV semester of second year of the Programme										
	ourse ectives	<ol> <li>Acquire a foundational understanding of the basic components of food.</li> <li>Learn the fundamental principles of food processing techniques.</li> <li>Explore the chemical reactions that occur during food processing and storage.</li> </ol>										
(	CO1	Acquire a founda	tional understanding	of the ba	asic c	ompon	ents o	f food				
C	CO2	Learn the fundan	nental principles of fo	ood proc	essin	g techr	niques	•				
C	CO3	Explore the chem	ical reactions that oc	cur duri	ng fo	od proc	essing	g and s	storage.			
C	CO4	Examine the basic	es of food microbiolo	ogy.								
C	CO5		o sensory evaluation arance of food production	ation techniques used to assess the taste, aducts.					aroma,			
Unit		Content		Contac	et	Lear	rning	Outco	ome	KL		
No.				Hour								
I		iction to Food Scien		6		earn ba	asics o	of food	l			
		ence and its importa			S	science				1,2		
	_	ents of food: carbol										
	_	itamins, minerals, w			T.	T 1 .	1.1		1			
II		rocessing Techniqu		6		Jndersta				1.0		
		s of food preservation	, -		p	processing techniques				1,2		
	•	ing, drying, freezing ckaging and storage	), techniques for									
III		cal Reactions in Fo	od Processing and	8	E	Explain	chemi	ical ch	anges			
	Storage	: Chemical changes	during cooking,		d	uring f	ood pi	ocessi	ing and	1,2		
	baking,	fermentation, and a	ging, factors		S1	torage						
	influenc	ing chemical reaction	ons: pH,									
	•	ture, enzymes										
IV		I <b>icrobiology</b> : Introd		8		Jndersta			al			
		ne pathogens and sp				hanges		1,2				
		al growth kinetics a	nd factors affecting		fe	ermenta	ation					
		al growth in foods										
V	-	Evaluation of Foo		8		Explain	_	_		1.0		
		evaluation: taste, ar				ensory				1,2		
		nce, methods and te	cnniques for		10	or quali	ıty ass	essme	nt.			
	sensory evaluation											

## **REFERENCE BOOKS:**

- R1. Miriah Pace and Rick Parker. Introduction to Food Science and Food Systems. 2nd Ed., Delmar Cengage Learning; 2016.
- R2. Srilakshmi. Food Science. 7th Ed., New Age International Publishers; 2018.
  R3. Potter. Food Science; 5th Ed., CBS Publishers & Distributors Pvt Ltd, India; 2007.

# **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/33254009/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Acquire a foundational understanding of the basic components of food.	1,4,8					
2	Learn the fundamental principles of food processing techniques.	1,2,3,8					
3	Explore the chemical reactions that occur during food processing and storage.	1,2,3,4,8					
4	Examine the basics of food microbiology.	1,2,3,4,6					
5	Gain insights into sensory evaluation techniques used to assess the taste, aroma, texture, and appearance of food products.	1,3,5					

	SEMESTER – IV										
Cour	se Title	Extra-0	Curricular A	ctivities							
Cour	se code	741   REC 771   R	Total Credit Total Hours:		T 0		<b>S 4</b>	R 0	O/F 0	<b>C</b>	
Pre-r	equisite	Nil	Co-req				Nil				
Progr	ramme	Bach	elor of Scien	ce in Microbiol	logy						
Seme	ster	Spring/ IV ser	mester of sec	ond year of the	Prog	gram	me				
		1. To ascertain physical and mental development of the students and select best									
	urse	performers for state, national and international level competition.									
Obje	ectives	2. To enhance and improve student's talents in the field of sports, yoga, music,									
		dance, drama, etc. throu	-			_					
	CO1	Enhance Leadership Skil	ls-Students w	vill develop lead	dersh	ip al	biliti	ies	throu	gh	
		various activities.	Q: 1 : 1								
C	<b>O2</b>	Improve Social Interaction	n-Students wi	Il learn to intera	ct and	d bui	ld re	elat	ionshi	ps	
		with others.	منطاما المامان	Ctudanta vvill	1_a	***	.4.4.	2772	an +1a		
C	O3	Develop Personal Interests and Hobbies- Students will explore and develop their									
		personal interests and hobbies.  Strengthen Problem-Solving Skills- Students will improve their ability to solve									
CO4		problems creatively and effectively.									
		Foster Cultural Awareness- Students will gain a better understanding and									
C	<b>O</b> 5	appreciation of different c		8					8		
Unit		Content	Contact	Learnin	g Ou	tcon	ne		K	L	
No.	D 1	4.1.2.4.4	Hour	<b>D</b>					1		
I		n the learner's interest they icipate in various sports,	60	By participating				ular		,2	
				sports, music, and co-curricular activities offered through							
		and co-curricular activities		activities offer	ed thi	rougl	h				
		and co-curricular activities the clubs of the University		activities offer university club		_		i11			
	joining (Footba	the clubs of the University ll, Futsal; Cricket; Swimmin		university club develop	s, stu	ıdent	s wi	ill			
	joining (Footba Basketb	the clubs of the University ll, Futsal; Cricket; Swimmin all; Badminton; Table Tenni	s;	university club develop physical and m	os, stu nental	ident l agil	s wi	ill			
	joining (Footba Basketb athletics	the clubs of the University ll, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoor	s;	university club develop physical and m leadership, tea	os, stu nental	ident l agil	s wi	ill			
	joining (Footba Basketb athletics games;	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals;	s;	university club develop physical and m	os, stu nental mwoi	ident l agil rk, ai	s wi	ill			
	joining (Footba Basketb athletics games; Photogr activitie	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are	s;	university club develop physical and m leadership, tea creativity. They will enha management, §	os, stunental mwon ance t gain p	l agil rk, an ime	ity, nd ical				
	joining (Footba Basketb athletics games; Photogr activitie encoura	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular	s;	university club develop physical and m leadership, tea creativity. They will enha management, g knowledge three	os, stumental mwon nnce t gain p	l agil rk, an ime practi worl	ity, nd ical	ops			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops,	s; or	university club develop physical and m leadership, tea creativity. They will enha management, g knowledge throwith renowned	os, stumental mwon ance t gain p ough l prof	l agil rk, an ime practi work	ity, nd ical ksho	ops s,			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and	s; or	university club develop physical and m leadership, tea creativity. They will enha management, g knowledge throwith renowned and build self-	nental mwon ance t gain p ough l prof	l agil rk, an ime oracti work ession denc	ity, nd ical ksho	ops s,			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies	the clubs of the University Il, Futsal; Cricket; Swimmin all; Badminton; Table Tenni and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops,	s; or	university club develop physical and m leadership, tea creativity. They will enha management, g knowledge throwith renowned	os, stumental mwon nnce t gain p ough l proficonficonal g	l agil rk, an ime practi work ession dence growt	ity, nd ical ksho onals e wh	ops s,			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies professi organisi	the clubs of the University II, Futsal; Cricket; Swimmin all; Badminton; Table Tennis and other outdoor and indoor Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and; Renowned skilled onals/ personalities are inviting workshops to promote the	s; or	university club develop physical and m leadership, tea creativity. They will enha management, g knowledge thre with renowned and build self- fostering person These activities cultural awaren	nental mwor ance t gain p ough l prof confie onal g	l agil rk, ar ime practi work ession dence growt mote inclu	ity, nd ical ksho onals e wh	ops s, hile			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies professi organisi	the clubs of the University ll, Futsal; Cricket; Swimmin all; Badminton; Table Tennis and other outdoor and indoo Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and; Renowned skilled onals/ personalities are invited.	s; or	university club develop physical and m leadership, tea creativity. They will enhamanagement, gknowledge through with renowned and build self-fostering person These activitie cultural awarer and lifelong leadership.	nental mwon ance t gain p ough l prof confi- onal g as pro- ness, arnin	l agil rk, ar rime practi work ession dence growt mote inclu	ity, nd ical ksho onals e wl h.	ops s, hile			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies professi organisi	the clubs of the University II, Futsal; Cricket; Swimmin all; Badminton; Table Tennis and other outdoor and indoor Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and; Renowned skilled onals/ personalities are inviting workshops to promote the	s; or	university club develop physical and m leadership, tear creativity. They will enhamanagement, gknowledge through with renowned and build self-fostering person These activities cultural awaren and lifelong lean encouraging st	nental mwon nnce t gain p ough l prof confic onal g es pro- ness, arning udent	l agil rk, an ime practi worl èssic denc growt mote inclu g, ts to	ity, nd ical kshoonals e wl i.h.	ops s, hile			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies professi organisi	the clubs of the University II, Futsal; Cricket; Swimmin all; Badminton; Table Tennis and other outdoor and indoor Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and; Renowned skilled onals/ personalities are inviting workshops to promote the	s; or	university club develop physical and m leadership, tear creativity. They will enhamanagement, g knowledge through with renowned and build self-fostering person These activities cultural aware and lifelong lean encouraging st their interests,	nental mwon nnce t gain p ough l proficonfic onal g es pro- ness, arnin- devel	l agillark, and ime practification world dence provided including the state of the	ity, nd ical ksho onals e wh h.	pps s, hile ity,			
	joining (Footba Basketb athletics games; Photogr activitie encoura club act competi hobbies professi organisi	the clubs of the University II, Futsal; Cricket; Swimmin all; Badminton; Table Tennis and other outdoor and indoor Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular ivities, workshops, tions as per their interest and; Renowned skilled onals/ personalities are inviting workshops to promote the	s; or	university club develop physical and m leadership, tear creativity. They will enhamanagement, gknowledge through with renowned and build self-fostering person These activities cultural awaren and lifelong lean encouraging st	nental mwon ance t gain pough l proficonficonal ges promess, arning development of the conficulty of t	l agill rk, an ime practi worlders worl	ity, nd ical ksho onalse e wl ch. e usivi	pps s, hile ity,			

# **REFERENCE BOOKS:**

- R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel
- R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

#### **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Enhance Leadership Skills-Students will develop leadership abilities through various activities.	6,7					
2	Improve Social Interaction-Students will learn to interact and build relationships with others.	6,7					
3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.	6,7					
4	Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.	6,7					
5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.	5,6,7					

		SE	MESTE	R – V								
Cour	se Title			riology an	d Virol	ogy						
Cour	se code	7/185//1841112	otal credi		) D	L	T	_	S	R	O/F	<u>C</u>
Duo u	a a visita	Nil		rs: 45T+60	)P	3	0	4	0	<u>  0                                   </u>	0	5
	equisite	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1										
	ramme	Bachelor of Science in Microbiology  Fall/ V. somestor of third year of the Programme										
Seme	ster	Fall/ V semester of third year of the Programme										
	ourse ectives	<ol> <li>To familiarize the students about the different diseases caused by bacteria &amp; viruses and prevention and control measures of the diseases</li> <li>To teach different diagnostic tests to identify the causative organisms</li> </ol>										
(	C <b>O</b> 1	Describe the types and charact	teristics o	f normal ar	nd transi	ient	flor	a o	f hur	nan 1	body.	
C	CO2	Compare different virulence f pathogenesis.	factors of	viral and	bacteria	l pa	tho	gen	s and	d the	ir role	in
C	CO3	Explain Common Bacterial Pa	thogens a	and Strategi	ies for F	reve	enti	on a	and (	Cont	rol	
C	CO4	Apply different staining and b	iochemica	al test for d	iagnosi	s of	bac	teri	al di	sease	e.	
										- 10		
	CO5	Explain Viral Pathogens and E	Effective I		ınageme	ent S	tra	tegi	es.			
Unit No.		Content		Contact Hour	Le	arni	ng	Ou	tcon	1e	ŀ	ΚL
I	Benefic	ial Microbial Interactions with I	Human:	6	Descr	ribe and explain the					1	1,2
	upper re	microbial population - Skin, more espiratory tract, intestinal tract, utract, eye.				normal microbial inhabitants of human body				у		
П	Definitions of Pathogen Infection, Invasion, Endemic, Pandemic and Epidemic. Virulence and Virulence factors, Entry of pathogens into the host and mechanism of bacterial pathogenicity, exotoxins, enterotoxins, endotoxins, neurotoxins, Carriers and their types, Opportunistic infections, Nosocomial infections, Transmission of infections, Sepsis				Describe, illustrate and explain the microbial virulence factors and pathogenicity					1	1,2	
Ш	pathogens- List of diseases of various orgas systems and their causative agents, symptomode of transmission, pathogenicity, prophylaxis and control of the following diseases. Staphylococcus aureus Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis, Escherichia coli, Salmonella, Vibrio chole Helicobacter pylori, Bacillus anthracis,			pathogens- List of diseases of various organ systems and their causative agents, symptoms, mode of transmission, pathogenicity, prophylaxis and control of the following diseases. Staphylococcus aureus Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis, Escherichia coli, Salmonella, Vibrio cholerae, Helicobacter pylori, Bacillus anthracis,						eir ı,		1,2
IV	Staining in diagr techniq metachi Biocher Coagula carbohy	pelicobacter pylori, Bacillus anthracis, dostridium, Treponema pallidum  aining techniques and biochemical test used diagnosis of pathogens – Staining chniques: Endospore, cell wall, flagella, etachromatic granules, hanging drop. diochemical tests: IMViC, Catalase, coagulase, Oxidase, TSI, fermentation of arbohydrates, starch hydrolysis, urease, elatine liquefaction, Use of selective media  Describe, illustrate and explain the principle and process of different diagnostic tests for identification of a bacterial pathogen				1	1,2					

V	Basic Virology: – General properties,	10	Describe, illustrate and	1,2
	Morphology, Epidemiology, pathogenesis-		explain the different viral	
	pathology- diagnostics procedure - clinical		diseases, their causative	
	manifestation - prevention and control		organisms, mode of	
	measures of- HIV, Pox virus, Influenza virus,		transmission, pathogenesis,	
	Rabies virus, Polio Virus, Hepatitis Virus,		prophylaxis.	
	Mumps, Measles, Rubella, Arbovirus			
	1. Study of normal micro-biota of mouth;	60	Proficiency in various	1,2,3,4
	isolation, identification and preservation		diagnostic tests for	
	of microorganisms		bacterial and fungal	
	2. Study of normal micro-biota of skin;		identification.	
	isolation identification and preservation			
	of microorganisms			
	3. Staining – Capsular staining by negative			
	staining, endospore staining,			
[g]	metachromatic granules, motility, fungal			
Practical	staining			
ra	4. Biochemical tests: IMViC, Catalase,			
_ P	Coagulase, Oxidase, TSI, fermentation of			
	carbohydrates, starch hydrolysis, urease,			
	gelatine liquefaction			
	5. Use of selective media for specific			
	bacteria			
	6. Antibiotic Sensitivity test			
	7. Methods of isolation and identification of			
	fungi from Human Body: Staining			
	methods- KOH and LPCB.			

- 1. Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill Livingston Company.
- 2. Medical Microbiology by Jawelz, Melnick, Geo R.Brokes Me Graw-Hill Company.
- 3. Medical Microbiology by Anantanarayan & Panekar, Orient Longman Limited.
- 4. Textbook Virology by Rhodes & Van Royen
- 5. Practical Microbiology by C.P. Baweja

#### **REFERENCE BOOKS:**

- 1. Bacterial Diseases by Wilson & Topley. Medical Microbiology by Cruckshank- Vol.I & Vol.II.
- 2. General Virology by Luria & Parnel Virology by Dimmock.

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com/

CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Describe the types and characteristics of normal and transient flora of human body.	1,2,8						
2	Compare different virulence factors of viral and bacterial pathogens and their role in pathogenesis.	1,2,8						
3	Explain Common Bacterial Pathogens and Strategies for Prevention and Control	1,2,4,8						
4	Apply different staining and biochemical test for diagnosis of bacterial disease.	1,3,5,8						
5	Explain Viral Pathogens and Effective Disease Management Strategies.	1,2,6,8						

SEMESTER – V												
Cou	rse Title				and Parasi					T		
Course code		24BSMB312R	Total cre	edits: 4 urs:  45T+3	$\frac{L}{3}$	T 0	P 2	S 0	R 0	0/F 0	4	
Pre-requisite		Nil	Co		Nil							
Programme		Bachelor of Science in Microbiology										
Semester		Fall/ V semester of third year of the Programme										
Course Objectives		<ol> <li>To familiarize the students about the Morphology and taxonomy of fungi and the parasites.</li> <li>To familiarize students about different diseases caused by fungi and parasites</li> <li>To familiarize about the prevention and control measures of the diseases caused by fungi and parasites</li> </ol>										
CO1		Comprehend the basic concepts of medically significant fungi and its application in detecting and recovering fungi from clinical samples.										
CO2		Enhance the knowledge of superficial, subcutaneous, cutaneous, systemic, and opportunistic infections with respect to etiology, pathogenesis, clinical manifestations, laboratory diagnosis, treatment, and preventive measures.										
CO3		Build foundation of the structures and the pathogenicity associated with various mycotoxins										
CO4		Acquire proficiency in the classification, morphology, pathogenicity, and laboratory diagnosis of prevalent protozoan diseases										
CO5		Developing skills in diagnosing in parasitic metazoan diseases through laboratory techniques and methods										
Unit No.		Content Contact Learning Outcome Hour							K	KL		
I	taxonom Detection clinical s	Introduction: Morphology of fungi of medical important and recovery of fungi fingular pecimens. Yeasts of medice, dimorphic fungi	10	Describe and explain the morphology and taxonomy of medically important fungi and the diagnostic procedure from the clinical specimens.						,2		
II	Mycoses – superficial, sub cutaneous, cutaneous, systemic and opportunistic– etiology, pathogenesis, clinical manifestation, lab diagnosis, treatment, prevention			15	Describe, illustrate and explain the pathogenesis, clinical manifestation, lab diagnosis, treatment and prevention of superficial, sub cutaneous, cutaneous, systemic, opportunistic mycoses						,2	
III		Fungal toxins- mycotoxins- structure, types and its pathogenicity				escribe, illustrate and explain e types of fungal toxins and sease					,2	
IV	Classification, Morphology, Pathogenicity, lab diagnosis of common protozoan diseases-Amoebiasis, Giardiasis, Trypanosomiasis, Malaria, Toxoplasmosis, Leishmaniasis. Classification Morphology, Pathogenicity			10	Describe, illustrate and explain the types of parasites host, source of infection, mode of infection, lab diagnosis and the morphology, pathogenesis and lab diagnosis of Protozoa, Flagelletes, Sporozoa					e	,2	
V	Laboratory diagnosis of common parasitic metazoan diseases— Ascariasis, Hook worm, Filariasis, Taenia infection			5	the morph and lab dia	Describe, illustrate and explain the morphology, pathogenesis and lab diagnosis of Ascaris, Hookworm, Filariasis, Taenia infection						

	1.	Microscopic Examination of	30	Proficiency in various	1,2,3,4
		filamentous fungi and yeast		diagnostic tests for fungal and	
	2.	Staining- lactophenol cotton blue		parasitic identification	
		staining, gram's staining			
न्न	3.	KOH mount, skin scrapping,			
tic		cultivation			
Practica	4.	Preparation of Sabouraud's medium			
P		with and without antibiotics			
	5.	Identification, sensitivity tests for			
		antifungal agents			
	6.	Leishman Staining and Giemsa			
		Staining			

- 1. Medical Microbiology by Anantanarayan & Panikar Orient Longman Limited.
- 2. Medical Parasitology by Arora and Arora, CBS Publishers & Distributors.

#### **REFERENCE BOOKS:**

- 1. Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill Livingston Company.
- 2. Parasitology by K.P.Chattergy Medical Microbiology by Jawelz, Melnick, Geo R.Brokes Me Graw-Hill Company.
- 3. Medical Mycology by Jagedeese Chander
- 4. Medical Microbiology by Jawetz

#### **OTHER LEARNING RESOURCES:**

www.youtube.com

https://www.microrao.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Comprehend the basic concepts of medically significant fungi and its application in detecting and recovering fungi from clinical samples.	1,2,3,6,8					
2	Enhance the knowledge of superficial, subcutaneous, cutaneous, systemic, and opportunistic infections with respect to Etiology, pathogenesis, clinical manifestations, laboratory diagnosis, treatment, and preventive measures.	1,2,3,4,6,8					
3	Build foundation of the structures and the pathogenicity associated with various mycotoxins	1,2,3,6,8					
4	Acquire proficiency in the classification, morphology, pathogenicity, and laboratory diagnosis of prevalent protozoan diseases	1,2,3,6,8					
5	Developing skills in diagnosing in parasitic metazoan diseases through laboratory techniques and methods	1,2,3,4,6,8					

	SEMESTER – V												
Cours	se Title	В	io fertilizer	Productio	n								
Cours	se Code	24BSMB314R	Total Credits: 1 Total Hours:30		L 0	T 0	P 2	S 0	R 0	O/F 0	C 1		
Pre-re	equisite	Nil	Co-r	equisite		•		N	Vil	•	•		
Progr	amme		Bachelor of	f Science ir	n Microl	biolo	gy						
Semes	ster	Fall/	V semester (	of third yea	ar of the	Pro	grar	nme					
	ourse ectives	On successful con with the basic pri						e abl	le to I	Familia	nrize		
(	Demonstrate proficiency in the isolation techniques for N2-fixing bacteria from va environmental samples, including soil and plant root nodules							arious					
C	CO2	Apply molecular and classification of N2-fixing		l methods	for th	e ac	cura	ite i	dentif	ication	tion and		
C	CO3	Utilize selective media a from diverse soil and rhi			to isolat	e pho	osph	ate st	abiliz	zing ba	cteria		
(	CO4	Apply molecular and classification of AMF sp		cal method	ls for the	he a	ccur	ate i	denti	fication	n and		
Unit No.		Content		Contact Hour	Le	earni	ng (	Outco	ome		KL		
I	potentia Isolation potentia bacteria the pote	n, identification and analy lities of N2 fixing bacteria n, identification and analy lities of phosphate stabiliz , Isolation, identification a entialities of Arbuscular m Trhizospheric soil	d analysis of the bacteria, d analysis of the stabilizing cation and assess  30 Students will be able to understand the process of biofertilizer production using microorganisms								,2,3,4		

- **R1**. Kannaiyan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi. Dubey, R.C. 2001.
- R2. P. S. Bisen. Fontiers in microbial technology. 1st edition. C.B.S. Publishers and Distributors; 1994

#### **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9227430/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Demonstrate proficiency in the isolation techniques for N2-fixing bacteria from various environmental samples, including soil and plant root nodules	1,2,3,4,8					
2	Apply molecular and biochemical methods for the accurate identification and classification of N2-fixing bacteria.	1,2,3,4,8					
3	Utilize selective media and culture techniques to isolate phosphate stabilizing bacteria from diverse soil and rhizospheric samples.	1,2,3,4,8					
4	Apply molecular and morphological methods for the accurate identification and classification of AMF species.	1,2,3,4,8					

SEMESTER – V											
Cours	se Title		Wild Life	Conserva		d Mar	agen	nent			
Cours	se code	24FSZO501R	Total credits: 3 Total hours: 45T	$\frac{L}{3}$	T 0	P 0	S 0	R	0/F 0	C 3	
Pre-re	equisite	Nil	Co-requisite				Ni	l			
Progr	amme	in Micr	obiol	ogy							
Semes	ster		Fall/ V semester	of third y	ear of t	he Pro	ogran	nme			
1	ourse jectives	conservation 2. To learn var 3. To compresspecies. 4. To develop wildlife con	ious techniques for hend the significant strategies for res servation.	assessing nce of ge	and mo	nitorir in the	ng wil con	dlife b servationuman	iodiversi on of w activitie	ty. vildlife	
	CO1	Explain ecologie	cal principles that u	nderpin w	ildlife c	onserv	ation	efforts	S.		
(	CO2	Describe the tec	hniques for assessin	ng and mo	nitoring	wildli	fe bio	odivers	ity.		
(	C <b>O3</b>		e of genetics in wild								
	C <b>O</b> 4	conservation go								vildlife	
Unit	C <b>O</b> 5	_	content   Contact   Learning Outcome   KL								
No.				Hour					<u>.                                 </u>		
I	Conserva principles interactio	al Principles in Vation: Introductions, ecosystem functions, population dynamics, and landscapents, and landscapents.	n to ecological cions, species namics, habitat	10	fund princ		al eco	ologica	l wildlife	1,2	
II	Wildlife Survey m technique	nes for Assessing Biodiversity: ethods, populations, biodiversity industrial GIS in wildlift	n estimation lices, remote	8	vario biod	ous tec	hniqu y ass	be and les for essmen	l apply	1,2	
III	genetic di	versity, vation genetics,	10	impo		e of g	he role enetics ation.		1,2		
IV	Activities Human-w conflict re based cor	ng Conflicts Between and Wildlife Conflict can essolution strategies as ervation, and sument practices.	onservation: uses and impacts, es, community-	10	strat betw	egies 1	o mit uman	igate c activit	explain onflicts ies and	1,2	
V	Conserva	orks in Wildlife and agreements,	7	polic		newo		l and t govern	1,2		

national wildlife laws, protected area		
management policies, wildlife trade		
regulations, and enforcement mechanisms.		

- 1. "Principles of Conservation Biology" by Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.
- 2. Conservation Biology: Foundations, Concepts, Applications" by Fred Van Dyke and Rachel L. Lamb
- 3. "Essentials of Conservation Biology" by Richard B. Primack

#### **REFERENCE BOOKS:**

- 1. "Wildlife Ecology, Conservation, and Management" by John M. Fryxell, Anthony R. E. Sinclair, and Graeme Caughley.
- 2. "Fundamentals of Conservation Biology" by Malcolm L. Hunter Jr. and James P. Gibbs.
- 3. "Conservation Genetics: Case Histories from Nature" by John C. Avise and John L. Hamrick.

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Explain ecological principles that underpin wildlife conservation efforts.	1,2,3					
2	Describe the techniques for assessing and monitoring wildlife biodiversity.	1,2,3					
3	Describe the role of genetics in wildlife conservation.	1,2,3					
4	Explain the strategies for mitigating conflicts between human activities and wildlife conservation goals.	1,2,3					
5	Describe the legal and policy frameworks that govern wildlife conservation	1,2,3					

			SEMESTER -	V								
Cours	e Title		7	Foxicology	y							
Cours	e Code	24FSFS501R	Total Credits: 3 Total Hours: 4		1 3	T 0	P 0	S 0	R 0	O/F 0	<b>C</b> 3	
Pre-re	equisite	Nil	Co-requis	site				Nil				
Progr	amme		Bachelor of Scie	nce in Mi	crob	iolo	gy					
Semes	ster	Fall/ V	semester of thi	rd year of	f the	Pro	gram	me				
Course Objectives		distribution, metabo organisms.  2. Acquire proficiency	distribution, metabolism, and excretion (ADME) of toxic substances in living organisms.  2. Acquire proficiency in analytical techniques used for the detection, quantification, and characterization of toxic substances in biological, environmental, and									
(	C <b>O</b> 1	Explain the foundation	of toxicological p	orinciples.								
	CO2	Classify different types Assess the risk associate	ed with exposure									
(	C <b>O</b> 4	Explain the mechanism of absorption, distribution, metabolism, and excretion of toxic substances within the body.										
(	C <b>O</b> 5	Utilize toxicological knowledge to assess and manage risks in environmental and occupational settings.										
Unit No.		Content	Contact Hour	I	Lear	ning	Outo	come		ŀ	ΚL	
I	<ul> <li>Deft toxi</li> <li>Hist toxi</li> <li>Relations</li> </ul>	ction to Toxicology: inition and scope of cology, tory and development of cological principles, ationship between dose an conse	10	Explain the foundational principles of toxicology, including the history and development of the field, the definition and scope of toxicology, and the relationship between dose and response.								
II Classification of Toxicants  • Types of toxicants: Chemical, biological, and physical • Sources and exposure routes of				Classify different types of toxicants, understand their sources and routes of exposure, and describe the principles of toxic kinetics and toxic dynamics.							1,2	
III	Risk Ass     Prin     Haz     char     Dos     Exp     Risk     man	nt 10	Assess the exposure applying assessment identification assessment and risk manager	e to to g prinent, i ation ent, e char	oxic nciple nclu n, dos expos acter	substes of a ding lase-res	tances risk hazaro ponse assess	by d e ment,		1,2		

IV	Mechanisms of Toxicity	10	Explain the mechanisms of	1,2
	<ul> <li>Absorption of toxic substances</li> </ul>		absorption, distribution,	
	• Distribution of toxic substances		metabolism, and excretion of toxic	
	<ul> <li>Metabolism of toxic substances</li> </ul>		substances within the body,	
	• Excretion of toxic substances		including the processes of	
	Biotransformation and		biotransformation and	
	bioaccumulation		bioaccumulation.	
V	Toxicology in Environmental and	7	Utilize toxicological knowledge to	1,2
	Occupational Settings		assess and manage risks in	
	Environmental toxicology: Impact		environmental and occupational	
	on ecosystems and human health		settings, understand the impact of	
	<ul> <li>Occupational toxicology:</li> </ul>		toxicants on ecosystems and	
	Workplace exposure and safety		human health	
	<ul> <li>Regulatory aspects and safety</li> </ul>			
	guidelines			

- 1. "Casarett & Doull's Essentials of Toxicology" by Curtis Klaassen and John B. Watkins.
- 2. "A Textbook of Modern Toxicology" by Ernest Hodgson

#### **REFERENCE BOOKS:**

- 1. "Patty's Toxicology" edited by Eula Bingham, Barbara Cohrssen, and Charles H. Powell
- 2. "Molecular, Clinical and Environmental Toxicology" edited by Andreas Luch
- 3. "Toxicology: The Basic Science of Poisons" by Curtis D. Klaassen

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping			
S.N.	N. Course Outcome (CO)  Mapped I Outc			
1	Explain the foundation of toxicological principles.	1,2,3		
2	Classify different types of toxicants.	1,2,3		
3	Assess the risk associated with exposure to toxic substances.	1,2,3		
4	Explain the mechanism of absorption, distribution, metabolism, and excretion of toxic substances within the body.	1,2,3		
5	Utilize toxicological knowledge to assess and manage risks in environmental and occupational settings.	1,2,3		

		SI	EMESTER – V								
Course	Title	Res	earch I (Review	of literatu	ıre)						
Course Code		24BSMB316R	Total Credits: Total Hours:		L 0	T 0	P 0	S 0	R 12	O/F 0	C 2
Pre-req	uisite	Nil	Co-requ		U	U		Ni		U	<i>L</i>
Program	nme		Bachelor of Sc	ience in M	icro	biolo	gy				
Semeste	er	Fall/	V semester of tl	hird year o	of the	e Pro	gran	nme			
Cou Objec		<ol> <li>Apply experimenta evaluation and for s</li> <li>Use relevant scienti</li> </ol>	tatistical treatme	_		cient	ific 1	task,	collec	ct data	a for
CO	)1	Learn to tabulate research	ch data								
CO	)2	Analyze research outcome									
CO	)3	Correlate with existing literature									
CC	)4	Prepare and effective di	ssertation report								
CO	)5	Able to communicate re	search outcome								
Unit No.		Content		Contact Hour		Lea	rning	<b>Out</b>	come		KL
I	search	nction, Comprehension or engines, Selection of Top	pic	30	rese men	earch thods earch	seares for s	ch en select c effe	ctivel	nd y	1,2,3
II								1,2,3			

- **R1**. "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell
- R2. "The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams
- R3. Research Methodology: Methods and Techniques" by C.R. Kothari

#### **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program					
3.11.	Course Outcome (CO)	Outcome					
1	Learn to tabulate research data	1,2,3,4,8					
2	Analyse research outcome	1,2,3,4,8					
3	Correlate with existing literature	1,2,3,4,8					
4	Prepare and effective dissertation report	1,2,3,4,8					
5	Able to communicate research outcome	1,2,3,4,8					

		SEMI	ESTER – V												
Cour	se Title		Extra-Curr	ricular Activ	ities										
Cour	se code	741   REC 31   R	Total Credits		L	T	P	S	R	O/F	C				
		]	Total Hours:		0	0	0	4 N:	0	0	1				
	equisite	Nil	Co-req	•	1.	1		Ni							
	ramme		chelor of Scie												
Seme	ster		mester of th												
l .	ourse jectives	<ol> <li>To ascertain physical and mental development of the students and select best performers for state, national and international level competition.</li> <li>To enhance and improve student's talents in the field of sports, yoga, music, dance, drama, etc. through AdtU club activities and workshops.</li> </ol>													
	C <b>O</b> 1	Enhance Leadership Skills-activities.													
(	CO2	Improve Social Interaction-others.								_					
(	C <b>O3</b>	Develop Personal Interests personal interests and hobbi	es.												
(	C <b>O</b> 4	Strengthen Problem-Solvin problems creatively and effectively	ectively.												
(	C <b>O</b> 5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.													
Unit No.		Content	Contact Hour	Lea	arni	ng O	utco	ome		I	KL				
I	participa and co-c clubs of Futsal; C Basketba athletics games; I Photogra activities encourag club acti competit hobbies; professio organisis	an the learner's interest they can the in various sports, music, urricular activities joining the the University (Football, Cricket; Swimming; all; Badminton; Table Tennis; and other outdoor and indoor Dance; Music; Vocals; aphy; Drama; Literary s); The students are ged to participate in regular vities, workshops, tions as per their interest and Renowned skilled onals/ personalities are invited by my students.		By participal music, and offered throstudents with physical and leadership, creativity. They will emanagement knowledge with renow build self-confostering perfectivities proposed activities proposed activit	co-co-co-co-co-co-co-co-co-co-co-co-co-c	university	cular versi versi p agili k, ar ime racti work ession e who will turty, a ng store s, de pass	activity clutty clutty, and cal cal cal cal cal nd li udent velopions	ops and nese felon ts to new that	SQ.	1,2				

R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

#### **OTHER LEARNING RESOURCES:**

https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Enhance Leadership Skills-Students will develop leadership abilities through various activities.	6,7					
2	Improve Social Interaction-Students will learn to interact and build relationships with others.	6,7					
3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.	6,7					
4	Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.	6,7					
5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.	5,6,7					

			SEMES'	TER – VI							
Cour	se Title				Гесhnology						
Cour	se code	24BSMB321R		redits: 4 ours: 45T	+30P	L T 3 0	P 2		R 0	0/F 0	<u>C</u>
Pre-r	equisite	Nil		Co-requisi		3   0	4	Nil		<u> </u>	
	ramme	В			in Microbio	ology					
Seme	ster	Spring/ V	T semest	er of third	year of the	Progr	amm	ie			
	ourse jectives	The objective of this fermentation processes     To teach the studer microorganisms.	s & the u	se of differe	ent microorg	ganism	s in ii	ndust	ries		
(	C <b>O</b> 1	Understand bioreactors as in diverse bioprocessing s			es, enabling	them to	o app	ly thi	is kı	nowle	dge
(	CO2	Understand different typinformed decisions in bio				empo	werin	g the	em	to m	ıake
(	CO3	Students will be well ver Processes and with the va									e up
(	CO4	Students will be well ver & Secondary metabolites		the screeni	ng techniqu	es, Mi	crobia	ıl ass	ays	, Prim	nary
	C <b>O</b> 5	Understand the productio	n process	of differer	nt types of fe	erment	ation	produ	uct.		
Unit No.		Content	Lear	ning (	Outco	me		K	KL		
I	Configurates, ba	of a basic fermenter, biorea aration, design features, indi- affles, impellers, foam separ , culture vessel, cooling and	vidual ators,	5	Describe a structure a fermenter	of	1	.,2			
II	batch, c importa	of cultures in the fermenter ontinuous and fed batch, nce of media in fermentation formulation and modification	n,	5	Describe, i explain the fermentation formulation	differ on proon	ent ty	pe's and		1	,2
III	filtration develop extraction	s separation by centrifugation, flocculation and other recoments. Cell disintegration, on, purification by differents, drying and crystallization	ent	8	Describe, i explain the of biomass disintegrat	differ separa	ent m	etho		1	.,2
IV	microbi of micro metabol strain in Immobi	n, selection and improvement al cultures: Screening and is corganisms, Primary and secutives, preservation of cultures approvement programme lization of cells and enzymente, Method of mobilization actions	solation condary s after	10	Describe, i explain the of isolation of industria microorgan process of	differ and pally im nisms	ent moreser porta and th	ethoo vation nt ne	n		,2
V	(penicil (Hepatir organic Lactic A	ion of pharmaceuticals: Ant lin), hormones (humulin), va tis B), Vitamin B12, Produc acids: Acetic Acid, Citric A Acid, Production of Amino a Glutamic Acid, Production	accines tion of acid, acids:	17	Describe, i explain the produced by by ferment		1	,2			

	Enzymes: Protease, Amylase Production of Fuels: Ethanol, Methanol, Mushroom Cultivation and Wine production			
Practical	<ol> <li>Preparation of Sauerkraut</li> <li>Role of yeast in bread making</li> <li>Wine preparation</li> <li>Vinegar production</li> <li>Production of mushroom</li> <li>Citric acid estimation</li> <li>Lactic acid estimation</li> <li>Production of fermented milk products</li> </ol>	30	Proficiency in preparing various products using industrial useful microorganism.	1,2,3,4

- 1. Stanbury P.F., A. Whitaker, S.j. Hall, Principles of Fermentation Technology Publisher: Butterworth-Heinemann
- 2. Shuler M.L. and F. Kargi: Bioprocess Engineering Basic Voncepts by Publisher Prentice Hall

#### **REFERENCE BOOKS:**

- 1. Prescott and Dunn's Industrial Microbiology, Publisher: Gerald Reed: Books
- 2. W. Crueger and A. Crueger: Biotechnology. A textbook of Industrial Microbiology, Publisher: Sinauer Associates.

#### **OTHER LEARNING RESOURCES:**

https://microbenotes.com

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Understand bioreactors and their various types, enabling them to apply this knowledge in diverse bioprocessing scenarios.	1,2,3,8,
2	Understand different type's fermentation processes, empowering them to make informed decisions in biotechnological applications.	1,2,3,8
3	Students will be well versed with fermentation media, inoculum preparation, Scale up Processes and with the various downstream processes of fermentation industries	1,2,3,4,6,8
4	Students will be well versed with the screening techniques, Microbial assays, Primary & Secondary metabolites.	1,2,3,6,8
5	Understand the production process of different types of fermentation product.	1,2,3,4,6,7,8

•	TEN 43	 	SEMEST		/* 135*	1.					
	se Title		dustrial and		eutical Mic		ology P	$\frac{1}{ \mathbf{S} }$	R	O/F	C
Cours	se code	24BSMB322R	Total Hours			_	2	0	0	0	4
Pre-re	equisite	Nil	Co	-requisite				N	il	•	
Progr	amme		Bachelor o	f Science ir	1 Microbio	logy					
Semes	ster	Spring	g/ VI semeste	r of third y	ear of the	Prog	ram	me			
	ourse ectives	<ol> <li>To incorporate a s microbiology prince</li> <li>Study the strategic failures and consecutive</li> </ol>	eiples, techniques in order to	ues, proces	ses				•		
	Understand basic pharmaceutical concepts such as definitions, sources, terminology and classification, and recognize the primary aspects of pharmacodynamics, including actions, therapeutic effects, and potential adverse or toxic reactions.  Comprehend the fundamentals of pharmacokinetics, covering absorption, distribution metabolism, interaction, and excretion processes.										
C	CO3	Understand the princip (GMP) in the pharmace			_	ood l	Manı	ıfact	uring	g Pract	tices
C	CO4	Attain proficiency in and contamination collayout, services, and cl	ntrol, encomp	passing kno	-	_				_	
C	CO5	Acquire expertise in t	•	•	•					•	
Unit No.		Content		Contact Hour	Lea	rning	Out	com	e	I	ΚL
I	sources	ction to pharmacology: I , terminology used, class codynamics— Actions, T e, toxic	ification,	9	Describe Pharmac						1,2
П	metabo	cokinetics— absorption, clism, interaction, excretion administration, Storage of	on, Routes	9	Describe explain to of drugs storage	ne Pha	arma	coki			1,2
III	pharma Applica Quality GMP Q	les and applications of G ceuticals and cosmetics I ations and Definitions Th the regulatory factors ( quality assurance beyond to practices in cosmetic m	Principles— e concept of QC, QA and GMP ISO,	9	Describe explain q drug mar assurance	uality ufact	aspo uring	ect o g, qu	ality		1,2
Premises and contamination control, location, design, structure, layout, services and cleaning. Personnel management, training, Hygiene and health. Documentation Quality control and GCLP Sterile and other products. Global regulatory and toxicological aspects of cosmetic preservation  9 Describe, illustrate and explain about quality management aspect of premises, Personnel Hygiene, documentation and regulatory.											1,2
V	cosmeti GCLP S	cal aspects for pharmace c Products, Quality cont Sterile and other products ics microbiology-testing	Describe, illustrate and explain about Sterile and non-sterile pharmaceutical products, efficacy and								

	and preservation antimicrobial preservation efficacy and microbial content testing, Validation method for cosmetics Preservation strategy, Evaluation of antimicrobial mechanism		evaluation of preservatives use in pharmaceuticals and cosmetics	
Practical	<ol> <li>Wine preparation</li> <li>Vinegar production</li> <li>Ethanol Production</li> <li>Screening of Antibiotic Producing Microorganisms from Soil</li> </ol>	30	Students will learn fermentation processes for wine, acetification for vinegar, ethanol production from various substrates, and methods to isolate antibiotic-producing microorganisms from soil.	1,2,3,4

- 1. Pharmaceutical Microbiology, by Dr. C. R. Kokare
- 2. Pharmaceutical Microbiology, Tim Sandle

#### **REFERENCE BOOKS:**

- 1. Pharmacology by Harvey and Champe, Wolters Kluwer Publication, 4Th Edition
- 2. Principles of Pharmacology, Armstrong, Wolters Kluwer Publication
- 3. Basic and Clinical Pharmacology, by Katzung, McGraw Hill, 10th edition
- 4. Pharmacology, Principles and Practice, Bachmann, Hecker, Messer, AP Publication

#### **OTHER LEARNING RESOURCES:**

https://www.pharmanotes.org/

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Understand basic pharmaceutical concepts such as definitions, sources, terminology, and classification, and recognize the primary aspects of pharmacodynamics, including actions, therapeutic effects, and potential adverse or toxic reactions.	1,2,6,8
2	Comprehend the fundamentals of pharmacokinetics, covering absorption, distribution, metabolism, interaction, and excretion processes.	1,2,6,8
3	Understand the principles and apply the knowledge of Good Manufacturing Practices (GMP) in the pharmaceutical and cosmetic industries.	1,2,3,4,6,8
4	Attain proficiency in quality management and regulatory aspects related to premises and contamination control, encompassing knowledge in location, design, structure, layout, services, and cleaning protocols.	1,2,3,4,6,8
5	Acquire expertise in the analytical aspects of pharmaceutical and cosmetic product quality control, incorporating Good Clinical Laboratory Practices (GCLP) principles.	1,2,3,6,8

		S	SEMESTI	ER – VI											
Course	e Title		Mushro	oom Cultiv	ation										
Course	e Code	24BSMB323R		redits: 1		L	T	P	S	R	O/F	<u>C</u>			
				lours:30		0 0 2 0 0 0									
	quisite														
Progra	amme	me Bachelor of Science in Microbiology													
Semes	ter	Fall/ V	semester	of third ye	ar of th	ne P	rogr	amn	ıe						
Course Objectives  1. To create awareness about the Mushroom among the people. 2. To strengthen the promotion of mushroom cultivation by establishin equipped laboratory and offices. 3. To know and explore the cultivation in Assam										ng a v	well-				
(	CO1	Explain different classes	of mushro	oom.											
(	CO2	Understand reproduction	n and grow	th of mush	room.										
(	CO3	Explain mushroom spaw	n product	ion											
(	CO4	Discuss the methods of o	cultivation	of mushro	om										
(	CO5	Explain the techniques for	or the utili	zation of n	nushroo	m sp	ent								
Unit No.		Content		Contact Hour	L	earı	ning	Out	come	2	K	KL .			
I	cultivation mother c spawn; p mushroo	f laboratory for mushroom on; preparation and product ulture, mother and comment reparation and cultivation of m; mushroom spent manage composting.	30	The st cultiva					to	1,2	2,3,4				

- R1. Gogoi, R., Rathaiah, Y., & Borah, T. R. (2019). Mushroom cultivation technology. Scientific Publishers.
- R2. Suman, B. C., & Sharma, V. P. (2007). Mushroom cultivation in India. Daya Books.
- R3. Petre, M. (2015). Mushroom biotechnology: developments and applications. Academic Press.

#### **OTHER LEARNING RESOURCES:**

https://www.researchgate.net/profile/Samarendra-

 $Hazarika/publication/342082516_Spawan_Production_Mushroompdf/data/5ee11b24299bf1b17a8b66ed/Spawan-Production-Mushroom.pdf$ 

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Explain different classes of mushroom.	1,2,3,8							
2	Understand reproduction and growth of mushroom.	1,2,3,8							
3	Explain mushroom spawn production	1,2,3,8							
4	Discuss the methods of cultivation of mushroom	1,2,3,8							
5	Explain the techniques for the utilization of mushroom spent	1,2,3,8							

SEMESTER – VI																	
Cours	e Title							Herbal	Medicin	ie							
Cours	e Code	2	24F\$	SBO	601R		Total Cr	redits: 3 ours: 45T		1 3	1 0	_	P 0	<u>S</u>	R 0	0/F 0	<b>C</b> 3
Pre-re	equisite			Nil				Co-requisi	te	- 3	Į U	,	U	Ni	_	U	
	amme					]		of Science		obiolo	gy						
Semes	ster				Spi	ring/ \	VI semest	ter of third	l year of	the P	rog	gra	mr	ne			
Course Objectives  2. To learn the methods of 3. To evaluate scientific li 4. To discuss the clinical a						pharmacological properties of medicinal plants. ds of formulation of herbal medicine. fic literature on herbal medicine. ical applications of herbal medicine. e legal and ethical issues related to herbal medicine.											
	CO1	Disc	cuss	phar	macc	ologica	al properti	ies of medi	cinal pla	nts.							
	CO2	1		_		_		on of herba	_								
	CO3							erbal medic									
(	CO4	Disc	cuss	clini	ical a	pplica	tions of h	erbal medic	cine.								
(	CO5	Und	derst	and t	he le	gal an	d ethical i	issues on he	erbal me	dicine							
Unit No.	Content							Contact Hour	I	Learni	ing	O	utc	ome	2	]	KL
I	Pharmace Plants: In bioactive of action, medicinal Methods Medicine of extracts (tinctures,	example example of Forms, decorate, and the contractions of the contraction of the contra	ction ound ples ss. rmu action	ls in to place of collection motion to the second s	plants plants ommo n of lethod technifusion	nacogn s, mec only us Herba s, prep iques ns, tab	hanisms sed	9	Descriproper action in med  Demor differe formul herbal	ties an of biodicinal instrate nt extration t	d nactipla pla kn act	ow ior	than	mpo ge o	ns of ound	f s	1,2
	capsules), products.	, stand	lardi	zatio	n of l	nerbal											
III	Evaluation Herbal M Research of clinical meta-anal	<b>ledici</b> metho l studio	ne: odolo es, s	ogies yster	, criti natic	cal ap	praisal vs,	9	Critica scienti herbal	fic lite medic	rati ine	ure	rel			ret	4,5
IV	Clinical Applications of Herbal Medicin Use of herbal medicine in treating common ailments, evidence-based applications, safety and efficacy, interaction with conventional medicines.							9	Discus applica efficac treating	ations, y of h g vario	saf erb ous	fety al 1 co	, a neo ndi	dicir tion	S.		3,4
V	Legal and Medicine Regulator intellectua considerat patient co	e: ry fram al prop tions i	newo perty in res	orks, righ	quali ts, et	itrol,	9	Unders legal a to the p herbal	nd eth practic	ical e a	l is nd	sue	s re	lated	d	1,2	

- TEXT BOOKS:

  1. "Pharmacognosy and Phytochemistry" by Vinod D. Rangari

  2. "Textbook of Pharmacognosy" by C.K. Kokate, A.P. Purohit, and S.B. Gokhale.

  3. "Herbal Medicine: Biomolecular and Clinical Aspects" edited by Iris F.F. Benzie and Sissi Wachtel-Galor

- 1. "The Complete Guide to Herbal Medicines" by Charles W. Fetrow and Juan R. Avila
- 2. "Principles and Practice of Phytotherapy: Modern Herbal Medicine" by Simon Mills and Kerry Bone
- 3. "Herbal Medicine: Expanded Commission E Monographs" by Mark Blumenthal

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Discuss pharmacological properties of medicinal plants.	1,2,3							
2	Explain the methods of formulation of herbal medicine.	1,2,3							
3	Evaluate scientific literature on herbal medicine.	1,2,3							
4	Discuss clinical applications of herbal medicine.	1,2,3							
5	Understand the legal and ethical issues on herbal medicine.	1,2,3							

	SEMESTER – VI														
Cours	e Title			nunity Nu		-				0.75					
Cours	e code	24FSFD601R	Total Credits: Total Hours:		1 L 3	T 0	P 0	S 0	R 0	0/F 0	<b>C</b> 3				
Pre-re	equisite	Nil		equisite		U	U	Nil		U					
Progr	amme		Bachelor of So	cience in N	/licrobiolog	y									
Semes	ster	Spring	/ VI semester o	of third year of the Programme											
		1. To understand the pri				_									
		2. To assess the nutritio	nal needs of cor	nmunities.	·										
	urse	3. To implement and ev	aluate communi	ity nutrition	n programs.										
Obje	ectives	4. To understand the ro	le of advocacy	and policy	developmen	ıt in	imp	rovin	g co	mmu	nity				
		nutrition.													
		5. To develop strategies					venti	on pr	ogra	ıms.					
	01		Explain the principles and practices of nutritional epidemiology.												
	02	Assess community nutr		<u> </u>		l me	thod	ologı	es.						
CO3		Implement and evaluat				to	imr	rove	cor	nmiin	itv				
C	<b>O</b> 4	Understand and apply advocacy and policy development to improve community nutrition.													
C	O5	Develop and implemen	t effective nutrit	tion educat	ion and inte	rven	tion	prog	rams	i.					
Unit				Contact	Learn	ing	Out	come	2	K	L				
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	• St	udy designs in nutritional		epidemiol			Onai								
	• M	easurement of dietary into		•											
			n nutritional												
II		idemiology unity Nutrition Needs A	ssessment	9	Assess co	mm	unity	nutr	ition	2	,3				
		ethods of assessing comn		-	needs usir		•				,				
	l	trition needs			tools and	metl	hodo	logie	s.						
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	cli	inical data	·												
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		ase studies of successful currition programs	ommunity												
		nallenges in implementing	g nutrition												
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IV		acy and Policy Developm		9	Understand		_			3	,4				
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		nciples of nutrition educa	tion		nutrition e										
		eveloping and implement	ng nutrition		and gain sl				and						
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strategies • Evaluating the interventions	e effectiveness of nutrition			
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- 1. "Nutrition in Public Health: Principles, Policies, and Practice" by Arlene Spark, Lauren M. Dinour, and Janel Obenchain.
- 2. "Community Nutrition in Action: An Entrepreneurial Approach" by Marie A. Boyle and David H. Holben

#### **REFERENCE BOOKS:**

- 1. "Modern Nutrition in Health and Disease" edited by A. Catharine Ross, Benjamin Caballero, Robert J. Cousins, Katherine L. Tucker, and Thomas R. Ziegler
- 2. "Essentials of Public Health Biology: A Guide for the Study of Pathophysiology" by Constance Battle.

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Explain the principles and practices of nutritional epidemiology.	1,2,3
2	Assess community nutrition needs using appropriate tools and methodologies.	1,2,3
3	Implement and evaluate community nutrition programs.	1,2,3
4	Understand and apply advocacy and policy development to improve community nutrition.	1,2,3
5	Explain the principles and practices of nutritional epidemiology.	1,2,3



## Assam down town University

## Curriculum and Syllabus

# Bachelor of Science in Food, Nutrition and Dietetics

## OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.2

## **FACULTY OF SCIENCE**

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the

programme and to be eligible for the degree. This volume also includes the prescribed literature,

study materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Damey

Member Secretary, Academic Council

#### Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

#### **Missions**

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well–rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multi disciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict—free global society.
- 6. To be renowned for creating new knowledge through high quality inter disciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stake holders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

#### **Programme Overview:**

B.Sc. in Food, Nutrition and Dietetics is a 3-year undergraduate programme which deals with offers a wide range of courses covering various basic and applied areas of nutritional sciences. The student develops an aptitude and scientific temperament to apply the technical skills in various important areas of Nutrition and Food such as Food Science, Nutritional biochemistry, Food Microbiology, Clinical Nutrition, Food Technology and Food Science. The course also offers various techno specific skills, universal ethics and elective courses considering overall development and employability scopes in research, industry and teaching sectors. The course duration is for a period of 3 years.

#### I. Specific Features of the Curriculum:

- Experiential learning
- Constructivist approach to learn
- Practical and project-based learning

#### II. Eligibility Criteria:

Minimum 45% in 10+2 with English, Biology & Chemistry 5% relaxation for SC/ST, EWS, and Specially abled candidates.

#### III. Program Educational Objectives (PEOs):

PEO 1-AdtU nutrition and dietetics graduates will be well-prepared for successful careers in industry, institution and/ or government sectors in one or more relevant disciplines/subdisciplines.

PEO 2-The nutrition and dietetics graduates will be academically prepared to become diet counsellor/ certified dieticians for evaluating nutritional status to improve health.

PEO 3-AdtU nutrition and dietetics graduates will actively participate in professional endeavours to elevate personal standing while concurrently making impactful contributions to the profession and society, achieving success in higher education within specific or interdisciplinary domains if pursued.

#### **IV. Program Specific Outcomes (PSOs):**

PSO 1: Techno-Professional Ability: Demonstrate a comprehensive understanding of multidisciplinary concepts of food nutrition and dietetics with an interdisciplinary approach to address nutritional challenges.

PSO 2: Outreach Competency: Fostering outreach competency for creating awareness in society through nutrition education and intervention for better public health.

PSO 3: Global Proficiency: Exhibit global competency to excel in the profession through international certification courses

#### V. Program Outcome (PO):

- PO1- Disciplinary Knowledge: Apply the knowledge of food science and dietetics principles, human biology, biochemistry, microbiology and fundamentals of nutraceuticals and functional foods for better human health.
- PO2- Problem-Solving: Identify, assess, analyze and plan an appropriate diet for specific health conditions.
- PO3- Communication: Effectively communicate to provide diet counselling, and personalized diet plans, conveying specialized nutritional knowledge to the individuals and community at large.
- PO4- Professional Ethics and Values: Comply with human values and ethics and its strict application in the profession.
- PO5- Research-In-Practice: Foster evidence-based advancements in nutritional science and dietary practices to address emerging challenges and improve public health.
- PO6- Food Formulation: Formulation and standardization of food products for value addition applying interdisciplinary knowledge.
- PO7- Individual and Teamwork: Function efficiently as an individual or a member/ leader in multidisciplinary teams.
- PO8- Lifelong learning: Ability to engage in independent lifelong learning in the broadest context of lifestyle, healthcare and technological advancement.

#### VI. Total Credits to be Earned: 134

#### VII. Career Prospects:

B.Sc. in Food Nutrition and Dietetics offers a range of dynamic career opportunities. Graduates can work in research and development, hospitals, and food processing industries. Roles include nutritionist, quality control analysts, and clinical researchers. Opportunities also exist in academia and education, where graduates can contribute to scientific knowledge and train future professionals.

#### **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semesterend examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting in-semester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination) *	30
2.	In-Sem Exam – II (ISE-II) (Written Examination) *	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers:**

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

**Note:** No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

#### VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-

Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade **Grade Points Description** 10 O Outstanding 9 Excellent A+8 Very Good A B+7 Good В 6 Above Average C 5 Average P 4 **Pass** F 0 Fail Abs 0 Absent **UFM** 0 Unfair Means

**Table 2: Letter Grades and Grade Points** 

#### iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses

graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### **b.** CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### **D.** Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

(i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.

- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favor because this strategy for teaching is seen to favor passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d.** Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned

problem. The same has to be done in group so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

#### The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

#### Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file.

#### SEMESTER WISE COURSE DISTRIBUTION

	Sl.	Carrage Cada	Course Title	Course	]	Eng	gag	gen	ner	ıt	Maximum Marks for					
	No.	Course Code	Course Title	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total	
	1.	24BSFD1101R	Food Science I	DSC -Major	3	0	2	0	0	0	4	60	40	100	200	
	2.	24BSFD1102R	Basics of Human Physiology and Anatomy	DSC- Minor	3	0	0	0	0	0	3	60	40	0	100	
	3.	24BSCH1101R	Basic Chemistry	DSC- Minor	2	0	2	0	0	0	3	60	40	100	200	
Semester I	4.	24BSFD1103R	Human Nutrition	DSC- Minor	2	0	0	0	0	0	2	60	40	0	100	
nes	5.	24UBFS1101R	Basic of Statistics	MDC	3	0	0	0	0	0	3	60	40	0	100	
Ser	6.	24UBPD1102R	Elementary English (CLPPD)	AEC	0	0	4	0	0	0	2	0	0	100	100	
	7.	24BSAG1001R	Agricultural Education	VAC	2	0	0	0	0	0	2	60	40	0	100	
	8.	24UBEC11016	Extra-Curricular Activities	Co and extra- Curricular	0	0	0	4	0	0	1	0	0	100	100	
			Total								20				1100	
	Sl.	Course Code	Course Title	Course	<u></u>	Engagement							num Ma			
	No.		Course True	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total	
	1.	24BSFD1201R	Food Science II	DSC - Major	3	0	2	0	0	0	4	60	40	100	200	
	2.	24BSMB1201R	Food Microbiology	Minor	3	0	2	0	0	0	4	60	40	100	200	
	3.	24BSBC1201R	Nutritional Biochemistry	DSC- Minor	3	0	2	0	0	0	4	60	40	100	200	
	4.	24BSAG1002R	Agriculture heritage	e MDC	0	0	2	0	0	0	1	0	0	100	100	
ter II	5.	24BAPS1206R	Psychology of Happiness	MDC	2	0	0	0	0	0	2	60	40	0	100	
Semester II	6.	24UBPD1202R	PDP English Courses	AEC	0	0	4	0	0	0	2	0	0	100	100	
	7.	24UBES1101R	Environmental Education (online)	VAC	2	0	0	0	0	0	2	60	40	0	100	
	8.		Design thinking and Entrepreneurship/ Ideation concept	SEC	1	0	0	0	0	0	1	0	0	0	100	
		24UBCC1201	CO Curricular Activities	Co and extra-Curricular	0	0	0	4	0	0	1	0	0	100	100	
		_	Total								21				1200	

	Sl.	Course Code	Course Title	Course	I	Ξng	gag	en	ner	ıt		Maxin	num Ma	ırks for	
	No.	Course Code	Course Title	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1.	24BSFD2101R	Food Technology	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSFD2102R	Food Preservation	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
	3.	24BSFD2001R	Entrepreneurship Development	DSC- Minor	3	0	0	0	0	0	3	60	40	0	100
rIII	4.	24BSFD2002R	Catering Management	DSC- Minor	3	0	0	0	0	0	3	60	40	0	100
Semester III	5.	24BSFD2003R	Rural Sociology and Gender inclusion in Agriculture	DSC- Minor	2	0	0	0	0	0	2	60	40	0	100
	7.	24BSCH2001R	Natural Product Chemistry	MDC	2	0	0	0	0	0	2	60	40	0	100
	8.		PDP English Courses	AEC	0	0	4	0	0	0	2	0	0	100	100
	9.	24BSFD2103R	Techniques of preservation	SEC	0	0	4	0	0	0	2	60	40	100	200
	10.	24BSFD2104R	Field Training	Field Training	0	0	0	4	0	0	1	0	0	100	100
	Total										23				1300
	Sl.	Course Code	Course Title	Course	Engagement							Maxin	num Ma	ırks for	•
	No.	Course Code	Course Title	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1.	24BSFD2201R	Basic Dietetics	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
	2.	24BSFD2202R	Advance Food Technology	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
emester IV	3.	24BSFD2203R	Nutrition through life cycle	DSC - Major	4	0	0	0	0	0	4	60	40	100	100
Semes	4.	24BSFD2204R	Community Nutrition	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
	5.		PDP English Courses	AEC	0	0	4	0	0	0	2	0	0	100	100
	6.		Aptitude Course	SEC	0	0	0	8	0	0	2	0	0	100	100
	7.	24UUHV2201	UHV	VAC	1	0	0	0	0	0	1	60	40	0	100
	8.		BLSS	VAC	0	0	2	0	0	0	1	0	0	100	100
	9.	24UUFL	Financial Literacy	MDC	1	0	0	0	0	0	1	0	0	0	100
			Total								23				100

	Sl.	C C- 1-	C T'41 -	Course	I	Ξng	gag	gen	ner	nt		Maxin	num Ma	rks for	
	No.	Course Code	Course Title	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1.	24BSFD3101R	Advance Dietetics	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
			and counselling												
	2.	24BSFD3102R	Food product	DSC - Major	3	0	2	0	0	0	4	60	40	100	200
			development	,											
r V	3.	24BSFD3103R	Post-harvest	DSC -	3	0	2	0	0	0	4	60	40	100	200
Semester V			technology	Major									10	100	
eme	4.	24BSFD3104R	Geriatric and	DSC -	4	0	0	0	$ _{0}$	0	4	60	40	0	100
Š		2 1831 8310 110	Pediatric Nutrition	Major	·	Ů	Ŭ	Ů	ľ	Ů	·		10		100
	5.		Logical Reasoning	SEC	0	0	0	8	0	0	2	0	0	100	100
			Course	SEC				-				Ů	Ů	100	
	6.	24BSFD3105R	Bakery Science	SEC	0	0	0	8	0	0	2	0	0	100	100
	7.	24BSFD3106R	Summer Internship	Internship	0	0	0	0	0	24	4	0	0	100	100
	8.		Mini Research -R1		0	0	0	0	12	0	2	0	0	100	100
	Total										26		12		
	Sl.	Course Code	Course Title	Course	I	Ξng	gag	gen	ner	ıt		Maximum Marks for			
	No.	Course Code	Course Tille	Category	L	T	P	S	R	О	С	IA*	SEE*	PE*	Total
	1	24DCED2201D	Research	DSC -	4	^	_	^	_	0	1	(0	40	0	100
Semester VI	1.	24BSFD3201R	Methodology	Major	4	0	0	0	0	U	4	60	40	0	100
este	2.	24DCED2202D	Hospital/Food	DSC -	0	0	10	20	_	0	10	0	0	200	200
eme	2.	24BSFD3202R	Industry Internship	Major	U	U	10	20	0	U	10	0	0	200	200
Š	2	24DCED2202P	Research Project	D 1	0	0	_	0	2.4	0	1	0	0	100	100
	3.	24BSFD3203R	(Mini Research-R2)	Research	0	0	0	U	24	0	4	0	0	100	100
		1	Total	ı							20				400
.t. T			4 CEE C									•	1.5		

*IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

	SEMESTER – I Course Title BASICS OF FOOD SCIENCE									
Course Ti	tle	1		_	_	_			1 -	
Course Co	ode 24BSFD111R	Total Credits: 4	L L	T	P	S	R	O/F	C	
Duo Dogui	site Nil	Total Hours: 45T+30	P 3	0	2	0	1:1 0	0	4	
Pre Requis		Co-requisite	ite Nil ce in Food, Nutrition & Dietetics							
Programi Semeste										
Semester Fall/ I semester of first year of the programme  1. To introduce the students the basics of nutrition.										
Course		sic food groups, cooking		in d	etails					
Objective	29	w concept of food science		in u	ctaris.	•				
CO1		mentals of food and nutr		l coo	king r	nethod	ls.			
CO2		ure, composition and nut						:h		
		ional aspect, selection, pr							uts and	
CO3	oilseeds and its to		Срагат	11, un	а арр	nouno	погр	u15 <b>0</b> 5, 11	aus ana	
~ .		ional importance, storage	e and co	king	techr	niques	and cl	hanges	during	
CO4	cooking of vegeta			2				2	2	
COF	•	linary role, nutritive valu	ue of sug	ar, fa	its and	d oil a	nd the	key pro	ocesses	
CO5	like caramelizatio	n, hydrolysis and crystal	lization							
Unit-No.	Cor	itent	Contac		Lear	rning	Outco	me	KL	
			Hour							
	Food Groups: Defini	·				ke the				
		ood according to origin and functions,				understand the deference between the				
	_	unctions of food groups, need for grouping bods, ICMR five food groups, balanced						the		
	diet.				_	of foo ng acti		for		
I		Methods of Cooking: Objectives / reasons				-			1,2	
	& advantage of cooking			students can confidence and skills that can						
	_	•	prepare them for a							
		edia, different cooking methods, merits and demerits of different cooking methods,			lifetime of healthy					
	their effect on nutrient	-	habits							
	Cereals: Structure, co									
TT	value of cereals, stora	-	Learning about cereals							
II	cereals, Characteristic	s of starch, use in	9	a	and composition				1,2	
	variety of preparations	s selection								
	Pulses, Nuts & Oilse	eds: Chemical								
	composition, Selection	*		Г	o lea	rn abo	ut the			
	variety of preparation,	-				onal co		ition		
III	and cost, effect of coo		10			trition	_		1,2	
	nutritive value of puls		10			eir hea			1,2	
	Nutritive value of com	•			enefit					
		ighlighting soyabeans,								
	Toxic constituents of	·								
	Vegetables & Fruits-	· ·				m ~ 41.	4: cc -			
IV	composition & nutrition in human nutrition, sto	. •	o			ng the				
1 1 1	vegetables, changes in		8	between vegetable and their health benefits				1,2		
	on cooking, effects of	_		"	iicii ili	cailli (	CHEIIL	.o	1,4	
	Fats & Oils- Nutritive			T	earni	ng the				
V	& oils, role of fat in co		9			-		_{k oil}	1,2	
•	Sugar and Related P	•	,		importance of fat & oil 1, and sugar in diet and				1,4	
	Sugai and Neiated P	i oducis. Naninive		a	nu su	gai III	uici al	14		

	value, Properties, characteristics & uses,		chemical reactions.	
	sugar cookery, Form of sugar and liquid sweetness, Caramelization, Hydrolysis,			
	Crystallization.			
	1. Prepare a recipe from each food group			
	2. Determination of hundred grain weight			
	3. Determination of moisture content of		Learning and analyzing	
Practical	legumes and oil seeds.	30	the importance of recipe	1,2,3,4
Fractical	4. Analyze the ph of different fruit juices by	30	from different food	1,2,3,4
	titration method		groups	
	5. Study about different extraction process of			
	oils			

T1: Norman N. Potter and Joseph H. Hotchkiss, Food Science, CBS publishers and distributors, Fifth edition, 2000

T2: Manay Shakunthala, N and Shadaksharaswamy M. Foods facts and Principles, New Age International (P) Ltd Publishers, 4th edition 2020.

#### **REFERENCE BOOKS:**

R1: Srilakshmi B. Food Science, New Age International (P) Ltd Publishers, 7th edition, 2018. R2: Rangana (2017) Manual Analysis of Fruits and Vegetables Product. Tata McGraw Hill Co. Ltd., New Delhi.

#### **OTHER LEARNING RESOURCES:**

https://agritech.tnau.ac.in/nutrition/nutri food diet icmr%20food%20groups.html

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Discuss the fundamentals of food and nutrition and cooking methods.	1,8					
2	Explain the structure, composition and nutritive value of cereals and starch	1,2,8					
3	Explain the nutritional aspect, selection, preparation, and application of pulses, nuts and oilseeds and its toxic constituents	1,2,8					
4	Explain the nutritional importance, storage and cooking techniques and changes during cooking of vegetables and fruits	1,2,8					
5	Summarize the culinary role, nutritive value of sugar, fats and oil and the key processes like caramelization, hydrolysis and crystallization.	1,2,6,8					

SEMESTER – I Course Title BASICS OF HUMAN PHYSIOLOGY AND ANATOMY												
Cour	rse Title	B	ASICS OF HUMAN I	PHYS L	T	AN	D ANA S	R	Y O/F	C		
Cour	se Code	24BSFD112R	Total Hours: 45T	3	0	0	0	0	0	3		
Pre R	Requisite	NIL	Co-Requisite			<b>.</b>	NIL		0	-		
	rammes	Bachelor of Science in Food, Nutrition & Dietetics										
	nester	Fall/ I semester of first year of the programme										
	1. To learn about the anatomical positions, gross and microscopic structure of the orga							gans				
C	ourse	and skeleton	and skeleton in the human body.									
_	ectives		lents in developing a be	_	_	e anat	omical	structu	ire and bas	sic		
Obj	cenves	1	functions of various b	•	•							
			out the gross structure									
	C <b>O</b> 1		normal position, function	onal a	nd cross s	ection	nal anat	omy of	f various			
	202	structures of the	<u> </u>	1	1			1.41				
	C <b>O2</b>	_	nsive knowledge on cel									
	C <b>O3</b>	and blood coagu	owledge about the diffe	erent t	nooa cells	s, aitte	erent ty	pes of	viooa groi	ıps		
			owledge on the gross st	tructu	re of diges	stive o	wstem	recnir	atory and			
	C <b>O</b> 4	cardiovascular s		ıı actu	of diges	,,, v C S	y sicill,	respire	wory and			
			ve knowledge on the g	ross si	tructure of	f Mus	culo –	skeleta	l -system a	ınd		
	C <b>O</b> 5	bones in the boo							J			
Unit		Con			Contact		т	0	4	KL		
No.		Col	ntent		Hour		Learni	ng Ou	tcome	KL		
	Introdu	ction To Anatom	ical Terms, Basic									
		ucture and Function of Cell				Students will be able to know				<i>i7</i>		
	• Level of Organization – Body Parts and Areas,			_	the anatomical terminology							
I		Planes and Sections. Common anatomical			7	and the basic function of the cell and cell organelles.				1,2		
		inology										
		ure and Function of Cell Membrane, Cellular										
	Transp	oori o – Skeletal-Syste	m and Range									
		•	types according to									
			types according to									
	_	orphology. ssue and its types										
	Cartila	• •			To 1	earn ab	out the	basic of				
II		~	fication, and movement	ts of	10				system	1,2		
	joints.	oints: definition, classification, and movements of oints.					bones					
	Muscle	fuscle and its types										
	For Spe	cific programs-										
	Radiolo	gy: Importance of	f different bones of hun	nan								
	body.											
	_	e System-										
			inal tract and accessory	1				_	uipped	1,2		
III	_	rgans of digestive system.			8							
	_	Composition and functions of gastric, pancreatic, intestinal, and biliary secretion.				about digestive System.						
		•	ecretion.		Students will understand and							
11.7	_	tory System-	oru traat		10							
IV		<ul><li>Anatomy of the respiratory tract</li><li>Mechanisms and Regulation of respiration.</li></ul>			able to apply the knowledge of respiratory system					1,2		
	• Mecha	msms and Kegula	mon or respiration.			OTTE	zspiratory system					

	T			
	Gaseous exchange in lung and tissues.			
	• lung volumes, and capacities.			
	• Respiratory abnormalities: Hypoxia, cyanosis,			
	dyspnoea, Asphyxia, hyperventilation,			
	hypoventilation, tachypnoea and bradypnea			
	Specific Program			
	ECC: Intrapleural and intrapulmonary pressures and			
	their changes with respiration, Hypoxia.			
	For Specific programs-			
	ECC: Description of larynx, trachea, and respiratory			
	centers.			
	Cardio vascular System and Blood:			
	Mediastinum – division			
	• Structure of heart and blood vessels.			
	• Systemic circulation, pulmonary circulation, and coronary circulation			
	• Cardiac output, cardiac cycle, conducting system of		Student will learn about the	
	heart.		mediastinum and its	
V	Heart sounds, pulse, blood pressure and their	10	contents, structures of heart	1,2
, The state of the	regulation.	10	blood vessels with their	1,2
	• Composition and functions of blood, Plasma, and		functions.	
	body fluids.		1000000000	
	• Functions of RBC, WBC, and platelets			
	Hemoglobin.			
	Blood hemostasis			
	Blood groups			
	• Dioon groups			

T1: Fundamentals of Anatomy by Pamela K Levangie, Cynthia C Norkin, JP Bros Medical Publishers, New Delhi

T2: Fundamentals of Medical Anatomy by Duane nudson, 2nd ed. 2007 Publisher Springer.

T3: A book of Physiology, Dr Khurana

T4: Ross and Wilson Anatomy and Physiology

#### REFERENCE BOOKS

R1: Medical anatomy, JP Bros Medical Publishers, Bangalore, 1st Indian Ed 1997

R2: Clinical Anatomy, JP Bros Medical Publishers, Bangalore, 5th Ed 1996, 1st Indian Ed 1998

R3: Review of Medical Physiology- Ganong William F.

R4: Physiological basis of Medical practice – Best & Taylor

#### OTHER LEARNING RESOURCES

https://admissions.uiowa.edu/academics/human-physiology

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Recognize the functional and cross sectional anatomy of various structures of the body.	1,8					
2	Gain comprehensive knowledge on cell, organs and organ system and their function.	1,8					
3	Explain different blood cells, different types of blood groups and blood coagulating factors.	1,8					
4	Discuss the gross structure of digestive system, respiratory and cardiovascular systems	1,8					
5	Have a descriptive knowledge on the gross structure of Musculo – skeletal - system and bones in the body.	1,8					

SEMESTER – I											
Course T	Title	HUMAN	NUT	RITIO	N						
Course C	Code 24BSFD113R	Total Credits: 2	L	T	P	S	R	O/F	C		
Course	24BS1B113K	Total Hours: 30T	2	0	0	0	0	2			
Pre Requisite Nil Co-Requisite Nil											
Programi		achelor of Science in									
Semeste		Fall/ I semester of fir									
Course	Δ	students the basics of n									
Objectiv	2. To understand the	Γο understand the functions, digestion, absorption, sources of nutrients.									
	3. To understand the	e symptoms of different									
CO1		c terms related to nutri			corr	elation v	vith hu	man healtl	h		
CO2		ctioning of nutrients in									
CO3	-	n of nutrients in terms of			ndit	tion.					
CO4	<b>7</b> 1	of disease and their trea									
CO5	Analyze the sympto	oms of the deficiency di									
Unit-	Con	tent		Contac	et	Learn	ing Oı	ıtcome	KL		
No.				Hour							
	Food, Nutrition and Hea										
	function of food, classific	-	5								
	to function and nutritive v										
-		chological and social function of food, history									
	_	nutrition and importance of food and nutrition				Underst	Understand the relation				
	in day today life.	ecommended Dietary Allowances: Definition,				of food and health					
		,									
	~	logical value, bioavailability, Minimal and									
		mal Nutritional Requirements, Formulation of A and Dietary Guidelines- Reference Man and									
	₹		d								
	Reference women, factors										
	Energy: Energy Balance,										
1	Requirements, Deficiency					To unde	rstand	the			
	·	bohydrates: Definition, classification and attion. Digestion and absorption, glycemic				requirement of energy			1.2		
	•			and					1,2		
	•	ex, dietary fiber and its importance, RDA, arces, metabolic disorder associated with					importance of CHO				
1		er associated with									
	carbohydrate. <b>Protein</b> : Definition, class	ification and function	+		_	To unde	retand	the			
	Assessment of protein qua	*				classific		шС			
	digestion and absorption,	• • • • • • • • • • • • • • • • • • • •		12		composi		nd	1,2		
	due to deficiency or exces					requiren					
	Fat: Definition, classifica					requiren	iciit oi	protein			
	digestion and absorption,		le l			To unde	rstand	the			
,	and nutritional significant	• •				classific		tii <b>c</b>			
	omega-3). RDA, sources,	,	-,	10		composi		nd	1,2		
	deficiency or excess, dieta		art	requirement							
	disease.	j j				1					
	Vitamins: Physiological 1	role, Bio-availability ar	ıd			To unde	rstand	the			
	requirements, sources, de	•				classific					
	soluble and water soluble			8 composition ar			ıd	1,2			
	Minerals: Physiological i		d		_			- , <b>-</b>			
	requirements, sources, De	-				and min					

(Calcium, Phosphorus, Magnesium, Iron, Fluoride,	the importance of water	
Zinc, Iodine)	in healthy lifestyle.	
Water: Distribution of water in the body, function		
of water, requirements and human water balance		
system, acid base balance		

T1: Sumathi R. Mudambi, Rajagopal, M.V., Fundamentals of Foods and Nutrition, New Age International (P) Ltd, Publishers, 6th edition, 2020.

## REFERENCE BOOKS

R1: Bamji, M.S., Textbook of Human Nutrition, Oxford, IBH Publishing (P) Ltd, 4th edition 2019.

R2: Srilakshmi, B. Nutrition Science, New Age International (P) Ltd, Publishers 7th edition (2017).

## **OTHER LEARNING RESOURCES:**

https://agritech.tnau.ac.in/nutrition/nutri food diet icmr%20food%20groups.html

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the basic terms related to nutrition and its correlation with human health	1,2,8					
2	Understand the functioning of nutrients in details.	1,2,8					
3	Analyze the function of nutrients in terms of disease condition.	1,2,8					
4	Illustrate the types of disease and their treatments	1,2,8					
5	Analyze the symptoms of the deficiency disease	1,2,8					

SEMESTER – I												
Cour	se Title		ELEMENT	ARY	ENG	LISH						
Cour	se code	24UBPD111R	Total credits: 2	L	T	P	S	R	O/F	C		
		240 DI DITIK	Total hours: 30P	0	0	4	0	0	0	2		
	equisite	Nil	Co-requisite				N					
Prog	ramme											
Sen	iester		Fall/ I semester of first year of the programme									
1. To enable students to identify and use parts of speech, articles, auxiliary v							y verbs, a	ınd				
Co	urse	construct affirmative and negative sentences.										
	ectives		nced grammar concepts:						ners, con	struct		
Obje	octives	••	sentences, and understa		_		•					
		1 ^ ^	aking skills: Enable stud									
		•	ntonation, and stress, an			•						
C	O1		recognize and apply par			ı, artic	les, an	d auxil	iary verbs	, and		
			rmative and negative ser									
C	<b>O2</b>		apply determiners, form	n diff	erent t	ypes o	f sente	nces, a	nd compr	ehend		
		degrees of compa										
C	О3	_	o confidently introduce			_			ciation,			
		·	ess, and effectively ask		•							
			sp the communication pr							tion		
C	<b>O</b> 4	• •	th formal and informal c	omm	unicat	ion, ar	nd ider	itify ba	rriers to			
		effective commun							<u> </u>			
C	<b>O</b> 5		e key components of an	effec	tive pi	esenta	ition ai	nd how	to use vis	sual		
	ı	aids proficiently.								<del></del>		
Unit-		Conto	ent		ontact -		Learn	ing Ou	tcome	KL		
No.	D :	C (TI)		ŀ	Iour					-		
		of Grammar (Flip	oped classroom)			Students will						
т	ii. Artic	of Speech eles iliary Verbs rmative and Negative Sentences			6		demonstrate a				1	1,2,
I									•	3		
							understanding of grammar rules.					
						grai	IIIIIar	rules.				
	i. Deter	mar (Flipped class	room)			Stu	donte x	will con	struot			
		ence Construction						cally co		1,2,		
II			ssertive, Imperative,		6	_		l senter		3,4		
	etc.)	es of Sentences (718	sseruve, imperative,			type		i sciitci	icc	3,4		
		ree of Comparison	e of Comparison			Гур						
		<del>-</del>				Stu	dents v	will cor	ifidently	+		
	_	ing Skills							lves and			
III		luction and Greetin	~		5		age in		1,00 0110	1,2,		
		unciation, Intonatio				_	-	ions wi	th	3		
iii. Asl		ing and offering inf	Formation					onuncia				
	Comm	unication Skills								+		
		luction to Commun	ication						ectively	1.0		
IV		ess and Types of Co			7			cate in		1,2,		
•					,			d infori	nal	3		
		iii. Formal and informal communication iv. Understanding Barriers to Communication				sett	ings.					
		tation Skills				Stu	dents v	will del	iver	<u> </u>		
$\mathbf{V}$	i. Introd	luction			8	wel	l-orgai	nized a	nd	1,2		
							_					

visually supported

ii. Essential characteristics of a good

presentation	presentations.	
iii. Use of Visual Aids in Presentation		

- T1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2. Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- T3. Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- T4. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

- R1. Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- R2. Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- R3. Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- R4. Murphy, Raymond,.(2012) English Grammar in Use Book with Answers: A Self-Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### OTHER LEARNING RESOURCES:

https://www.ef.com/wwen/english-resources/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Equip students to recognize and apply parts of speech, articles, and auxiliary verbs, and to create both affirmative and negative sentences.	3,4,8					
2	Teach students to apply determiners, form different types of sentences, and comprehend degrees of comparison.	3,4,8					
3	Prepare students to confidently introduce themselves, use proper pronunciation, intonation, and stress, and effectively ask for and provide information.	3,4,8					
4	Help students grasp the communication process, differentiate between communication types, manage both formal and informal communication, and identify barriers to effective communication.	3,4,8					
5	Teach students the key components of an effective presentation and how to use visual aids proficiently.	3,4,8					

			SEMESTE	R – I								
Cours	e Title		EXTRA-C	URRI	CUL	AR AC	TIVI	ΓIES				
Cours	e code	24UBEC111R	Total credits: 0	).5	L	T	P	S	R	O/F	C	
					0	0	0	2	0	0	0.5	
	equisite	Nil Co-requisite Nil										
	amme		Bachelor of Scien									
Sem	ester	Fall/ I semester of first year of the programme										
		1. To ascertain physical and mental development of the students and select best performers for state, national and international level competition										
Cou	urse	performers for state, national and international level competition.										
<b>Objectives</b>		2. To enhance and improve student's talents in the field of sports, yoga, music, dance,										
		drama, etc through AdtU club activities and workshops.  3 To strengthen Problem-Solving Skills to solve problems creatively and effectively										
			3. To strengthen Problem-Solving Skills to solve problems creatively and effectively.  Enhance Leadership Skills-Students will develop leadership abilities through various									
CO	01	activities.	isinp skins-student	.5 W111	deve	op icau	Cisinp	aomin	s unou	gii varic	rus	
			Improve Social Interaction-Students will learn to interact and build relationships with									
CC	)2	others.										
CC	32	Develop Personal Interests and Hobbies- Students will explore and develop their										
CC	<i>)</i> 3	personal interests and hobbies.										
CC	74	Strengthen Problem-Solving Skills- Students will improve their ability to solve										
		*	vely and effectively									
CO	05	Foster Cultural Awareness- Students will gain a better understanding and appreciation of										
		different cultures.										
Unit-		Conte	nt	Con			Learr	ing O	ıtcome	;	KL	
No.	D 1	41 1		Но	ur							
		on the learner's i	•									
		pate in various spricular activities										
		University (Footl										
		t; Swimming; Ba				Studer	nte will	develo	n and i	refine		
		nton; Table Tenr						s and ta	_			
		· ·	or games; Dance;					pation		•		
		Vocals; Photogr	•	60	n		_	$\epsilon$ , and $\epsilon$			1,2	
1		y activities); The		0		_		ting fro			1,2	
		•	te in regular club					l engag	_	J1 t		
		les, workshops, c			_		nd com	_	10			
		iterest and hobbid				WOIKSI	порза	na com	pennoi	.15.		
		professionals/ pe										
		•	shops to promote									
		ents of the studen										
	the talk	on the studen										

## **REFERENCE BOOKS:**

R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

## **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}\\$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Enhance Leadership Skills-Students will develop leadership abilities through various activities.	3,4,8					
2	Improve Social Interaction-Students will learn to interact and build relationships with others.	3,4,8					
3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.	3,4,8					
4	Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.	3,4,8					
5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.	3,4,8					

			SEMESTE	R – I							
Course	Γitle			CHEM	IISTI	RY					
Course	code	24FSCH101R	Total credits: 2	L	<u>T</u>	P	S	R	O/F	C	
Pre Requ	uisita	Nil	Total hours: 30T	2	0	0	0 N	0	0	2	
Progran			achelor of Science in	n Food	Nutri	tion o					
Semest		Di									
Semest	i Ci	Fall/ I semester of first year of the programme  1. To give the knowledge about Chemical Kinetics and Ionic Equilibrium									
Cours Objecti		<ol> <li>To give the knowledge about Chemical Kinetics and Ionic Equilibrium.</li> <li>To give a detailed description of atomic structure, different theories related to it and the knowledge of classical and quantum chemistry.</li> <li>To give the knowledge of the periodic properties and HSAB theory.</li> </ol>									
CO1			of the rate law equation						e" and		
COI			dency of reaction rate								
CO2		solubility	of electrochemistry,								
CO3		mechanics and Sch	ze atomic structure, prodinger wave equat	tion				inciple	, Quantum	l	
CO4			of chemical bonding								
CO5			Describe the different types of organic reactions along with their mechanisms. organic molecules and their stereochemistry.								
Unit- No.		Conte	nt	Contac Hour		Le	arning	g Outco	ome	KL	
I	First	mical Kinetics: Order, rand second order, ration, temperature detactions.	nth order rate	5	in to cl th ra	To identify the order (0, 1 or 2) associated with each integrated rate law equation, to describe the "half-life" of a chemical reaction. Understand the temperature dependence of rate of reactions through Arrhenius equation.				1,2	
п	electrolytes, ionization constants of weak acids and bases, pH, buffers, solubility				ex co el ao	xplain oncepts ectroc	the unes of electrical the of	trate arderlying ctroched cells, buffer	g emistry,	1,2	
Ш	Boh beha deB Unc appi Qua Schi vario orbi 3s, 3	Atomic Structure: Recapitulation of Bohr's theory and its limitations, dual behavior of matter and radiation, deBroglie's relation, Heisenberg Uncertainty principle. Need of a new approach to atomic structure. What is Quantum mechanics, Time independent Schrodinger equation and meaning of various terms in it. Wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. (Only graphical representation) Rules for filling electrons in various orbitals, electronic		5	ey H pri ar ec gr di	Describe, illustrate and explain the atomic structur. Heisenberg Uncertainty principle, Quantum mecha and Schrodinger wave equation. To learn about the graphical representation of different atomic orbital and how the electrons are filled the orbital.			nucture, nty nechanics e out the on of al and	1,2	

	configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.			
IV	Chemical bonding: Various theories, covalent, hydrogen Bonding. Effective nuclear charge, atomic and ionic sizes. 6 Ionization energies, electron affinity and electronegativity, hard soft acids and bases.	7	Describe, illustrate and explain the concepts of chemical bonding by using various theories, periodic properties like Atomic and Ionic size Ionization Energy Electron Affinity, Electronegativity of elements of periodic table.	1,2
V	Organic Reactions and Stereochemistry: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule, Representations of 3 dimensional structures, structural isomers and stereo isomers. Configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.	7	Describe, illustrate and explain the different types of organic reactions along with their mechanisms. How to design syntheses of organic molecules. Acquire the knowledge of stereochemistry of organic molecules.	1,2

#### **REFERENCE BOOKS:**

R1: Graham Solomons. Solomons's Organic Chemistry, Global Edition. Wiley; 2017.

R2: Bahl, Bahl. A Textbook Of Organic Chemistry. 22th Edition. S Chand Publishing; 2019.

R3: Eliel and Wilen. Stereochemistry of Organic Compounds. 1st Edition. Wiley-Interscience. 1994.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5869253/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the order of the rate law equation, then characterize the "half-life" and temperature dependency of reaction rates using the Arrhenius equation.	1					
2	Explain the concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility	1,2					
3	Illustrate atomic structure, Heisenberg Uncertainty principle, Quantum mechanics and Schrodinger wave equation.	1					
4	Elucidate the concepts of chemical bonding, periodic properties.	1,2					
5	Explain the different types of organic reactions along with their mechanisms, organic molecules and their stereochemistry.	1,2					

		SEMESTER -	I							
Course T	itle	CELL B	IOLO	OGY						
Course co	ode 24BSZO101R	Total credits: 2	L	T	P	S	R	O/F		C
		Total hours: 30T	2	0	0	0	0	0		2
Pre Requi		Co-requisite				Nil				
Program		Bachelor of Science in F								
Semeste		Fall/ I semester of first								
	of cytology in	1.Introduce and make students understand about the fundamentals and advances of cytology including structure and functions of cell and cell organelles, cell								
Course		ion, also by observing it u			_		_			
Objectiv	2. To inculcate knows	owledge and skills on var		taınınş	g tech	niques,	, and	underst	and	cell
	structure by obs	erving them under micros	_	1	1		1. 1 . 1 .		1	
		y in laboratory techniques scopy, cell culture, and m		-				gy rese	arcı	1,
CO1		ar organization, functions						fferenc	es	
	1	ne structure, function, cel		_						in
CO2	transportation.	,, •••	-8-			P1			-	
CO3	•	somal structure and types	<b>5.</b>							
CO4	Understand the m	Understand the mechanism of cell to cell communication.								
CO5	Describe the cell	cycle and division in gene	eral an	d in so	ome s	pecific	cell t	ypes.		
Unit-No.	Con	ntent		tact our	L	earnin	ıg Ou	tcome		KL
I	Prokaryote and Eukary Function of cells); <b>Too</b>	hdamentals of Cell Biology: (Cell theory, karyote and Eukaryote cell: Structure and action of cells); Tools and Technique of tology: (Microscopy and Staining).			Describe, illustrate and explain cell organization and functions, microscopy and structural differences.				1,2	
п	Cell Membranes: Mod Cell junctions and adhe proteins; Membrane Pr potential; Transport acr	esion; Transport oteins; Membrane	1	0	Describe, illustrate and explain membrane structure, function; cell				1,2	
Ш	organization: nucleoso	ganization: nucleosome, solenoid model, romatid, centromere and telomere); Types pecial type).			Describe, illustrate and explain chromosomal structure and types.			somal		1,2
IV	IV Cell trafficking and signalling: cell signals; signalling pathways; cell surface receptors, protein phosphorylation; Quorum sensing phenomenon.  Bescribe, illustrate and explain the mechanism of cell to cell communication					1,2				
V	Cell Division & Cell C growth and differentiat cells, Germ cells, Canc Necrotic cell death	ion; Overview of Stem	1	0	Describe, illustrate and explain the cell cycle and division in general and in some specific cel types				1,2	

T1: Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002.

#### **REFERENCE BOOKS:**

R1: Cooper GM. The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates; 2000.

R2: Ambrose and Dorothy. Cell Biology. 2nd Edition. MEasty, ELBS Publications; 1970.

R3: Sharp, Lester W. Fundamentals of Cytology. 52th edition. Mc Graw Hill Company; 2011.

## **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/books/NBK9839/?term=cell%20Biolpgy

CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Understand cellular organization, functions, microscopy and structural differences.	1, 2, 3				
2	Describe membrane structure, function, cell organization and the proteins involved in transportation.	1, 2, 3				
3	Elaborate chromosomal structure and types.	1, 2, 3				
4	Understand the mechanism of cell to cell communication.	1, 3				
5	Describe the cell cycle and division in general and in some specific cell types.	1, 2, 3				

			SEMESTER-II							
Course 7	Γitle		COMMUNITY I	NUT	RITI	ON				
Course (	aho ^r	24BSFD121R	Total Credits: 4	L	T	P	S	R	O/F	C
Course	Joue	24DSFD121K	Total hours: 45T+30P	3	0	2	0	0	0	4
Pre Requ	iisite	Nil	Co-Requisite		•		N	il		
Program			achelor of Science in Food							
Semest	ter		pring/ II semester of first	•			rogramı	me		
Course		1.To know about nutritional problems prevailing in India.								
Objecti		-	n education to the communi	-						
			l learn assessing nutritional					••	• ,1	• .
CO1			ritional problems revealing							society
CO2	,		ritional status of people/gro	ups	throu	gh d	ifferent	meth	od of	
CO2		assessment.	Lavalyata pytmitian intanyan	tion		0.400.0	to 00ml	ot m	ماسىيىلىنىن	
CO3		_	l evaluate nutrition interven nal and international agenc		_					JII
CO ₄			assessing nutritional status		o upii	ıııng	gnuirin	onai s	tatus	
COS	'	Different method of	assessing nutritional status		Conta	ot	Ι.	arni	n G	
Unit-No.		Content			Hou			utcon	_	KL
	Nutr	ition and Health in N	ational development		1100	1		utton		
		Nutrition and Health in National development.  Definition, IMR, NMR and MMR. RAP, nutritional								
		tus assessment and surveillance.								
		tritional Problems in India-Malnutrition-								
τ	mear	nning, factors contributing to malnutrition,			10		Learnin	1.2		
I		rnutrition.			10		nutrition	1,2		
	Nutr	itional disorders-Epid	emiology, clinical features,				deficien	icy ai	sorder	
	preve	ention and dietary trea	atment for Protein Energy							
		nutrition, nutritional anaemias & vitamin								
		ciency disorders.								
		thods of assessing nutritional status:								
		1 0 1	dentification of risk groups,	.						
		Direct assessment-Diet surveys, anthropometric,					Learnin	g abo	ut	
11		clinical and biochemical estimation.			0		various	1.2		
II		Indirect assessment- Food balance sheet,			9		assess the nutritional			1,2
		ecological parameters and vital statistics.					status			
		Frowth chart Ieaning, WHO Chart, and charts used in India, uses,								
		neaning of reference curve and growth curve.								
			s-introduction, need, audio-							
		al aids, teaching aids	, ,							
		•	aning, objectives, types and							
	meth	ods; Principles of pla	nning, execution and							
	evalu	evaluation of nutrition education program; Merits and limitations.  Improvement of nutrition of a community:					Learnin	σ aho	ant	
	limit							_	lucation	
III	_				12		to impro			1,2
			vement or nutritional				_		on	
	_	quality of food, food fortification, enrichment and					communication			
		ent supplementations.								
			s and messages in nutrition							
	and h	nealth, Antenatal and	postnatal care.							

IV	Nutritional and infection relationship: Immunization and its importance, Food borne infection and intoxication diseases, foods involved, methods of prevention, Infestation of food borne diseases, Outbreak, Prevention signs and control of infection.	7	Learning about nutritional deficiency and its relationship	1,2
V	National and International agencies in uplifting the nutritional status-WHO, UNICEF, CARE, ICMR, ICAR, CSIR	8	Learning about various	1,2
Practical	<ol> <li>Diet and nutrition surveys: Identification of vulnerable and risk groups.</li> <li>Diet survey for breast-feeding and weaning practices of specific groups.</li> <li>Use of anthropometric measurement in children.</li> <li>Preparation of visual aids.</li> <li>Field visit to observe the working of nutrition and health oriented programmes (survey based result).</li> <li>Visit to hospitals to observe nutritional deficiencies.</li> </ol>	30	Equip students with the knowledge and skills to conduct dietary and nutritional surveys to identify vulnerable and at-risk populations, particularly focusing on breastfeeding and weaning practices	1,2,3,

T1: Public Nutrition, Indira Gandhi National Open University School of Continuing Education

## **REFERENCE BOOKS:**

R1: Temple, N. J. and Steyn, N. Community Nutrition for Developing Countries Athabasca University Press and UNISA Press 2016

## **OTHER LEARNING RESOURCES:**

https://www.youtube.com/watch?v=UT4uitoPnwk

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Familiarize with nutritional problems revealing among various communities in the society	1,2, 8					
2	Enable to assess nutritional status of people/groups through different method of assessment.	1,2,3,7, 8					
3	Plan, implement and evaluate nutrition intervention programs to combat malnutrition	1,2,3,7, 8					
4	Understand on national and international agencies to uplifting nutritional status	1,2,3,7, 8					
5	Different method of assessing nutritional status.	1,2,3,7,8					

			SEMESTER – II							
Course Ti	itle		FOOD PRESI	ERVA	ГЮ	N				
Course co	de	24BSFD122R	Total credits: 4	L	T	P	S	R	O/F	C
			Total hours: 45T+30P	3	0	2	0	0	0	4
Pre-requis		Nil	Co-requisite				Ni			
	Programme Bachelor of Science in Food, Nutrition & Dietetics									
Semeste	r		pring/ II semester of firs			ie prog	ramı	ne		
Course			nportance and need of pres							
Objective		•	inciples and process of pro		ion.					
			fferent preservation metho							
CO1			different preservation tech				is in l	ndıa		
CO2		•	e on principles and method	•			. 1			1
CO3			nning methods and their e	ilects (	on tr	e nutri	ional	aspe	cts of fo	oa.
CO4		*	ssing of Vegetables.	C	:4 1			:	11	1 1 .
CO5		preserves, candies.	ocessing methods, focusing	ig on ii	unt	beverag	es, ja	m, je	ny, marn	narade,
		preserves, candles.		Cont	o o t					
Unit-No.		Content				Lea	rning	g Ou	tcome	KL
				Hou		To lea	ırn an	d una	derstand	
	<b>Introduction to preservation:</b> History of Food			8					of food	
I	l .	Preservation. Scope of Food and Vegetable				proces				1,2
	Pre	Preservation in India.				Preser				
	Pri	Principles and methods of preservation:								
	Foo	Food Spoilage, Principles of preservation,				To lea	rn th	e diff	erent	
II	Me	Methods of preservation: Pasteurization,				preser	vatio	n me	thod and	1,2
	stei	sterilization, blanching, canning, drying,				its pri	ncipa	1		
	refi	refrigeration.								
		Canning of fruits and vegetables: Canning:								
			facture, canning process,							
		ection of fruits and v				To learn the different			erent	
III		washing, peeling, cutting, blanching, cooling,				process of preservation			1,2	
	l .	filling, exhausting, sealing, processing, cooling and storage; types of canning pressure canning and water bath canning, common causes of			12	applicable in fruits and vegetable				1,4
	l .									
		ilage in canning of t				To 100	nn +1-	2 12 11 1	0000:	
	l .		les: Pickling, chutneys nushroom processing,			and de		_	cessing	
IV	l .	ato processing, Som		10		preser				1,2
	_	ducts from vegetabl				vegeta	_	nouu	Ct OI	
			ruit Beverages, Jam,					e pro	cessing	
		-		12		and de		_	_	
V		Jelly and Marmalade, Preserve, Candied and Crystallized Fruits, Some other Valuable				preser		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	.• 01	1,2
	Products from Fruits					produ		fruits		
			vegetables			_				
		<ul><li>Pickling of fruits and vegetables</li><li>Pickling of meat and fish</li></ul>				Learn	ing a	nd an	plication	
VI		reparation of chutne					_	_	_	1,2,3,4
Practical		reparation of Sauces	•	30		of processing and preservation of diffe			, ,-,-	
		reparation of jam an	•			food g				
		reparation of squash	•							
			<u> </u>		<u> </u>				<del></del>	

T1: Desrosier, N. W. and Desrosier, J. N. (1987). The Technology of Food Preservation. CBS Publishers and Distributors, New Delhi

## **REFERENCE BOOKS:**

R1: Srivastava, R. P. and Kumar, S. (1998). Fruit and Vegetable preservation – Principles and practices. CBS Publishers and Distributors, New Delhi

## **OTHER LEARNING RESOURCES:**

https://actascientific.com/ASNH/pdf/ASNH-03-0529.pdf

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Learn and discuss different preservation techniques and methods in India	1,8					
2	Provide knowledge on principles and methods of preservation	1,2,6,8					
3	Analyze various canning methods and their effects on the nutritional aspects of food.	1,2,6					
4	Describe the processing of Vegetables.	1,6					
5	Explain the fruit processing methods, focusing on fruit beverages, jam, jelly, marmalade, preserves, candies.	1,6					

		SEMESTER -					·			
Course Ti	tle	BASIC D		_					_	
Course co	de 24BSFD123R	Total credits: 4	L	T	P	S	R	O/F	C	
		Total hours: 45T+30P	3	0	2	0	0	0	4	
	Pre-requisite Nil Co-requisite Nil									
Programm		Bachelor of Science in F	-							
Semester Spring/ II semester of first year of the programme										
		1. To study about different aspect of diet modification and adaptations.								
Course		2. To study about the different nutrient modification at different disease state.								
Objective	_	3. To have comprehensive understanding of diet therapy and the crucial role of dietitians in the healthcare industry								
CO1		<u> </u>	o of a dia	tioi	on in h	aalth	0000 1	ndustmi		
CO2	_	ept of diet therapy and role								
CO2		spects of diet modification					igni m	anagem	ent.	
CO3		rtance of a hospital diet in edge of nutrition in diet me					actinal	traat die	andona	
CO4										
CO5	problems	edge of nutrition in diet me	oumcall	JII 1	oi iivei	and	omar	y system	l	
	problems		Contac	٠t						
Unit-No.	Co	ontent	Hour		Lea	rnin	g Out	come	KL	
	Concept of diet the	rapy: growth and source								
	of dietetics, purpose									
		odification of normal								
	_	iet, classification of therapeutic diets, role								
		f Dietician, definition of nutritional care,								
	· ·	nterpersonal relationship with patient,								
	1 -	lanning and implementary dietary care.			Learning about					
_		Jutritional care process. Medical History							1.2	
I	_	ssessment. Assessment of patient needs.				different concept of diet			1,2	
	Dietary counseling-H	vietary counseling-Evaluation of the			therapy					
	effectiveness of cour	ffectiveness of counseling. Education of the								
	patient and follow up	_								
	Role of Dietitian–Pro	tole of Dietitian–Professional code and thics of a dietitian. Problems in feeding hildren at the hospitals, Psychology of								
	ethics of a dietitian.									
	children at the hospit									
	feeding the patient.									
		weight management-								
	Obesity and overwei	-			Learn	ing a	bout			
II	etiology, dietary mar	C	7			_	care f	or	1,2	
	behavioural modifica	ŭ	•				nagen		- ,-	
	Etiology, assessment	t and dietary					8			
	management.									
	Nutritional care for				т		1 .			
III	Acute, chronic and re		7		Learn	_			1,2	
	• •	ology, symptoms and			nutrit	ıonal	care		-	
	dietary management.									
	Nutritional care for				т		1 .			
13.7	_	ct- Gastric and duodenal	7		Learn	_			1.2	
IV		stipation, malabsorption	7				care f	or	1,2	
	_ ·	ids, ulcerative colitis,			diseases					
	flatulence and steato	rrnea-Etiology,								

	symptoms and dietary management.			
V	Nutritional care for diseases of liver and biliary system- Viral hepatitis, cirrhosis of liver, cholelithiasis and cholecystitis: Etiology, symptoms and dietary management.	10	Learning about nutritional care for various clinical condition	1,2
VI Practical	Planning, preparations and calculations of diets with modified consistency Planning, preparations and calculations of diets with modified fibre and residue Planning, preparation and calculation of diets in diarrhea Planning, preparation and calculation of diets in constipation Planning, preparation and calculation of diets in peptic ulcer. Planning, preparations and calculations of diets with modified consistency	30	Learn to plan & prepare different diet with modified fibre and residue	1,2,3,4

T1: Srilakshmi, B., Dietetics, New Age International (P) limited Publications, 2004.

#### **REFERENCE BOOKS:**

R1: Joshi, S. A., Nutrition and Dietetics, Tata McGraw Hill Publications, New Delhi, 2004.

## OTHER LEARNING RESOURCES:

https://www.youtube.com/watch?v=2K07gJ2t5u8 https://www.youtube.com/watch?v=PXWZ8vzcJI0

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the concept of diet therapy and role of a dietician in health care industry.	1, 8					
2	Apply different aspects of diet modification and adaptations for weight management.	1,2,5,8					
3	Explain the importance of a hospital diet in febrile conditions.	1,2,5,8					
4	Apply the knowledge of nutrition in diet modification for gastrointestinal tract disorders.	1,2,5,8					
5	Apply the knowledge of nutrition in diet modification for liver and biliary system problems	1,2,5,8					

			SEME	STER – I	I						
Course	e Title		ENVI	RONMEN	ITAL	SCIE	ENCE	E			
Course	e code	24UBES101R	Total cred		L	T	P	S	R	O/F	C
			Total hours		2	0	0	0	0	0	2
Pre-rec		Nil	Co-requi		1 1	4 • 4 •			Vil		
Progra			Bachelor of Scie								
Seme	ester		Spring/ II seme					_		1 .	
		1. To prepare students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented interdisciplinary perspective.									
		environmental issues from a problem-oriented, interdisciplinary perspective.  2. To develop a world population that is aware of and concerned about the environment and									
Cou		its associated pro									
Objec	etives	commitment to v				_					
		and prevention o		y and con		iy tow	aras	oratio	115 01 00	arem pre	OTCITIS
		3. To gain knowled		nservation	of bic	diver	sitv a	nd its	importa	nce.	
		The students will b	-				-		-		xt of
CC	)1	environmental issue									
-	22									impacts	of
CC	)2	Students will learn about natural resource, its importance and environmental impacts of Human activities on natural resource									
CC	)3	Gain knowledge ab	out environmen	t and ecos	ystem	, Stud	ents v	will be	able to	understa	nd the
CC	JS	concept of biodiver	sity and respect	them							
CC	)4	Gain knowledge about the conservation of biodiversity and its importance.									
CC	)5	Aware students abo	_	environme	ntal p	ollutio	on, its	s impa	ct on hu	man and	
		ecosystem and con	trol measures.		ı						
Unit-		Content		Contact		I	earn	ing O	utcome		KL
No.				Hour						•	
									es comb		
	Multi	disciplinary nature								111.41	
I		onmental studies: D		4				•	lving co	mplex	1,2
•	and in	nportance, Need for p	public	•					areness a	-	1,2
	aware	wareness.			_				r promo		
						ainab			1	8	
	Natur	al Resources: Rene	wable and								
	non-r	enewable resources	, Natural								
	resour	ces and associated p	roblems. Forest								
	resour	ces: Use and over-ex	xploitation,								
	defore	station, case studies.	Timber		Nat	ural re	esoura	res ho	th renev	wahle	
		extraction, mining, dams and their effects						able, f		vaoie	
		est and tribal people.							ncluding	r	
		ces: Use and over-ut			_				e of wat		
II		e and ground water,		6			-		ental cha		1,2
	_	ht, conflicts over war							od, and	_	
		ts and problems. Min			deg	radati	on. In	dividu	ials play	a a	
		Use and exploitation, environmental			_				ving res		
	effects of extracting and using mineral resources, case studies. Food resources:			and	prom	oting	sustai	nability			
		food problems, char									
		lture and overgrazing	-								
	_	n agriculture, fertiliz	_								
		ems, water logging, s	•								
	Proof	iii, water rogging, s	ammy, case								

	1: D			
	studies. Energy resources: Growing			
	energy needs, renewable and non-			
	renewable energy sources, use of alternate			
	energy sources.			
	Case studies. Land resources: Land as a			
	resource, land degradation, man induced			
	landslides, soil erosion and			
	desertification. Role of an individual in			
	conservation of natural resources.			
	Equitable use of resources			
	for sustainable lifestyles			
	<b>Ecosystems:</b> Concept of an ecosystem.			
	Structure and function of an ecosystem.			
	Producers, consumers and decomposers.		This module covers ecosystems,	
	Energy flow in the ecosystem. Ecological		including their concept, structure,	
	succession. Food chains, food webs and		functioning, and diversity. Students	
	· ·		_	
III	ecological pyramids. Introduction, types,	4	will learn about energy flow,	1,2
	characteristic features, structure and		ecological succession, and various	
	function of the Following ecosystem: -		ecosystem types like forests,	
	Forest ecosystem, Grassland ecosystem,		grasslands, deserts, and aquatic	
	Desert ecosystem, Aquatic ecosystems		ecosystems.	
	(ponds,			
	streams, lakes, rivers, oceans, estuaries)			
	<b>Biodiversity and its conservation:</b>		This module covers biodiversity,	
	Introduction – Definition: genetic, species		including its definition, value,	
	and ecosystem diversity. Bio-		levels, and threats. Students will	
	geographical classification of India.			
	Value of biodiversity: consumptive use,		learn about India's bio-geographical	
13.7	productive use, social, ethical, aesthetic	_	classification, its status as a	1.2
IV	and option values. Biodiversity at global,	5	megadiversity nation, and key	1,2
	National and local levels. India as a		biodiversity hotspots. They'll also	
	megadiversity nation• Hot-sports of		explore threats like habitat loss,	
	biodiversity. Threats to biodiversity:		wildlife poaching, and human-	
	habitat loss, poaching of wildlife, man-		wildlife conflicts, crucial for	
	wildlife conflicts.		conservation efforts.	
	<b>Environmental Pollution:</b> Definition			
	Cause, effects and control measures of:-			
	Air pollution, Water pollution, Soil			
	pollution, Marine pollution, Noise			
	pollution, Thermal pollution, Nuclear		This module covers environmental	
	hazards. Solid waste, Management:		pollution, including causes, effects,	
$\mathbf{V}$	Causes, effects and control measures of	5	and control measures, alongside	1,2
			waste management and disaster	
	urban and industrial wastes. Role of an		preparedness strategies.	
	individual in prevention of pollution.			
	Pollution case studies. Disaster			
	management: floods, earthquake,			
	cyclone and landslides.			
	Social Issues and the Environment:		This module explores social-	
VI	From Unsustainable to Sustainable	6	environmental dynamics, including	1,2
V 1	development. Urban problems related to	U	urban energy challenges, water	1 -,-
	energy. Water conservation, rain water		conservation, and resettlement	

	harvesting, watershed management.		issues. It delves into environmental	
	Resettlement and rehabilitation of people;		ethics, climate change impacts, and	
	its problems and concerns. Case Studies.		relevant legislation like the	
	Environmental ethics: Issues and		Environment Protection Act,	
	possible solutions. Climate change, global		emphasizing public awareness and	
	warming, acid rain, ozone layer depletion,		enforcement challenges.	
	nuclear accidents and holocaust. Case			
	Studies. Waste land reclamation.			
	Consumerism and waste products.			
	Environment			
	Protection Act. Air (Prevention and			
	Control of Pollution) Act. Water			
	(Prevention and control of Pollution) Act.			
	Wildlife Protection Act. Forest			
	Conservation Act. Issues involved in			
	enforcement of environmental legislation.			
	Public awareness.			
	Human Population and the			
	Environment: Population growth,		This module covers human	
	variation among nations. Population		population dynamics, including	
	explosion – Family Welfare Programme.		growth, impact on the environment	
VII	Environment and human health. Human	4	and health, along with initiatives	1,2
	Rights. Value Education. HIV/AIDS.		like Family Welfare Programs and	
	Women and Child Welfare. Role of		the role of information technology,	
	Information Technology in Environment		illustrated with case studies.	
	and human health. Case Studies.			
	Field work: Visit to a local area to			
	document environmental assets		Fieldwork objectives include	
	river/forest/grassland/hill/mountain.		documenting environmental assets	
	Visit to a local polluted site-		like rivers and forests, assessing	
VIII	Urban/Rural/Industrial/Agricultural.	5	pollution in urban or rural sites, and	1,2
	Study of common plants, insects, birds.		studying local biodiversity and	
	Study of simple ecosystems-pond, river,		ecosystems such as ponds and hill	
	hill slopes, etc.		slopes	
	(Field work Equal to 5 lecture hours)			

#### **REFERENCE BOOKS:**

R1: Bharucha. Textbook of Environmental Studies for Undergraduate Courses. 2nd edition. Orient Blackswan Publishing; 2019.

R2: Trivedy Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R). B.S. Publications; 2010.

R3: Trivedi, Goel. Introduction to air pollution. 1st publication. Techno-Science Publication (TB); 2003.

## **OTHER LEARNING RESOURCES:**

https://pubmed.ncbi.nlm.nih.gov/22274891/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	The students will be able to appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.	1,4				
2	Students will learn about natural resource, its importance and environmental impacts of Human activities on natural resource	1, 4				
3	Gain knowledge about environment and ecosystem, Students will be able to understand the concept of biodiversity and respect them	1, 4				
4	Gain knowledge about the conservation of biodiversity and its importance.	1, 4				
5	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.	1, 2, 4				

			SEMESTE								
Course	Title	IMPLICATIVE	E ENGLISH (COMM								
Course	code	24UBPD123R	Total credits: 2		Г Р	S	R	O/F	C		
			Total hours: 30P	0	0 4	0	0	0	2		
Pre-req	`	Nil	Co-requisite		Nil						
Progra					utrition and Dietetics						
Seme	ster				r of the programme						
			ts with the skills to into	erchange se	entence ty	pes, u	se vario	ous tenses	, and		
		correct common grammatical errors.  2.To enable students to effectively use one-word substitutions, understand homonyms									
Cou			•					•	ns		
Object	tives	-	s, avoid commonly con					_	4		
		-	s understand the nature	and types	oi iistenii	ig, and	overc	ome barri	ers to		
		effective listenin	ig.  vith the ability to trans:	fama ganta	true	tilia.	diffor	ant tangan	and		
CO	1		grammatical mistakes.	iorin sentei	ice types,	utilize	e differ	em tenses	, and		
			s to proficiently apply	one word s	ubetitutio	nc dif	forontic	ate hetwee	n		
CO	2	_	omophones, avoid frequency								
	_	and phrases in the		ichtry com	used wor	us, and	inicor	Joraic Idic	71113		
		•	comprehending the var	ious aspec	ts and tyr	es of 1	istenin	g. and in			
CO	3		rercoming obstacles to	_				8,			
			in employing effective		_	extract	ting rel	evant			
CO	4		texts, and utilizing the	_	_		Ü				
CO	_		on the significance of ti			l provi	de four	ndational			
CO	5	strategies to manag	ge their time efficiently	у.							
CO	6	Lead students in c	reating a well-rounded	and profes	ssional Li	nkedIn	profile	e.			
Unit-		Conte		Contact							
		V.0111.0	ent		1 Le	arning	o Outc	ome	$\perp$ KL		
No.				Hour	Le	arning	g Outc	ome	KL		
No.		nmar (flipped class	sroom)	Hour					KL		
No.	i. Inte	nmar (flipped class erchange of Interrog	sroom) gative and Assertive	Hour	Student	s will	accura	tely			
No.	i. Inte	nmar (flipped class erchange of Interrog nces, Exclamatory	sroom) gative and Assertive	Hour 6	Student	s will	accura transfo	tely orm	1,2,		
No.	i. Inte Sente Sente	nmar (flipped class erchange of Interrog nces, Exclamatory	sroom) gative and Assertive		Student constru various	es will ct and senter	accurateransfo	tely orm es and			
No.	i. Inte Sente Sente ii. Ty	nmar (flipped class erchange of Interrog nces, Exclamatory nces pes of Tenses	sroom) gative and Assertive		Student	es will ct and senter	accurateransfo	tely orm es and	1,2,		
No.	i. Inte Sente Sente ii. Ty iii. Co	nmar (flipped class erchange of Interrog nces, Exclamatory nces pes of Tenses ommon Errors	sroom) gative and Assertive and Assertive		Student constru various	es will ct and senter	accurateransfo	tely orm es and	1,2,		
No.	i. Inte Sente Sente ii. Ty iii. Co Voca	nmar (flipped class erchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Developme	sroom) gative and Assertive and Assertive		Student constru various correct	es will ct and senter gramn	accurate transforce typenatical	tely orm es and errors.	1,2,		
I	i. Intersection Senter Senter ii. Ty iii. Co	nmar (flipped class erchange of Interrog nces, Exclamatory ances pes of Tenses ommon Errors bulary Developme word substitution	sroom) gative and Assertive and Assertive	6	Student constru various correct	es will ct and senter gramn	accurar transfo nce typ natical	tely orm es and errors.	1,2, 3		
I II	i. Inte Sente Sente ii. Ty iii. Co Voca One v Home	nmar (flipped class erchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Developme word substitution onyms and Homoph	sroom) gative and Assertive and Assertive		Student constru various correct  Student vocabu	es will ct and senter gramn	accurare transformed type natical enhance and use well	tely orm es and errors.	1,2,		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Home Word	nmar (flipped classer change of Interrogences, Exclamatory ences pes of Tenses ommon Errors bulary Development on State of Tenses of State of State of Tenses of Tense	sroom) gative and Assertive and Assertive	6	Student constru various correct	es will ct and senter gramn	accurare transformed type natical enhance and use v	tely orm es and errors.	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom	nmar (flipped class erchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Developme word substitution onyms and Homoph is often confused as and phrases	sroom) gative and Assertive and Assertive	6	Student constru various correct  Student vocabu accurat	es will ct and senter gramm es will lary an	accurar transforace typ natical enhance	tely orm es and errors. ee their words	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Home Word Idiom	nmar (flipped classer change of Interrogences, Exclamatory ences pes of Tenses ommon Errors bulary Development on State of Tenses of State of State of Tenses of Tense	sroom) gative and Assertive and Assertive	6	Student various correct  Student vocabu accurat	es will senter grammers will lary and ely in els will	accurar transformee typ natical enhance ad use v context	tely orm es and errors. ee their words t.	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Liste i. Wh	mmar (flipped class erchange of Interrog nces, Exclamatory and nces pes of Tenses ommon Errors bulary Developme word substitution onyms and Homoph is often confused as and phrases ning Skills	sroom) gative and Assertive and Assertive	6	Student various correct  Student vocabu accurat  Student effective	es will senter grammers will lary and es will lary and es will re liste	accurateransformer typenatical enhance duse vecontext	tely orm es and errors. ee their words t. strate tills and	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Liste i. Wh ii. Ty	mmar (flipped class erchange of Interrog nces, Exclamatory and nces pes of Tenses ommon Errors bulary Developme word substitution onyms and Homoph is often confused as and phrases ning Skills at is listening?	sroom) gative and Assertive and Assertive ent	6	Student various correct  Student vocabu accurat	es will senter grammers will lary and es will lary and es will re liste	accurateransformer typenatical enhance duse vecontext	tely orm es and errors. ee their words t. strate tills and	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Home Word Idiom Liste i. Wh ii. Ty iii. U	mmar (flipped class crchange of Interrogences, Exclamatory conces pes of Tenses common Errors bulary Development on the substitution confused as and phrases ming Skills at is listening?	sroom) gative and Assertive and Assertive ent	6	Student constru various correct  Student vocabu accurat  Student effectiv identify	es will senter grammers will lary and ely in electric listen	accurater transformer type natical enhance duse we context demoning sking bar	tely orm es and errors. ee their words t. strate tills and criers.	1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Liste i. Wh ii. Ty iii. U	mmar (flipped classer change of Interrogences, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onlyms and Homophes often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listen	sroom) gative and Assertive and Assertive ent nones	6	Student constru various correct  Student vocabu accurat  Student effective identify  Student	es will ct and senter grammers will lary are ely in ces will re lister listen es will	accurar transformer type natical enhance duse we context demoning sking barread effects	tely orm es and errors. ee their words t. strate tills and	1,2, 3 1,2, 3		
I	i. Interest Senter Sent	mmar (flipped class crchange of Interrogences, Exclamatory conces) pes of Tenses ommon Errors  bulary Development word substitution onlyms and Homophels often confused as and phrases of Skills at is listening?  pes of Listening conderstanding Listening Skills	gative and Assertive and Asser	6	Student various correct  Student vocabu accurat  Student effectividentify  Student and ext	es will senter grammers will lary and ely in elisten els will ract re	accurar transformer type natical enhance duse we context demoning sking barread efflevant	tely orm es and errors.  te their words t.  strate tills and triers.	1,2, 3 1,2, 3		
I	i. Interest Senter Sent	mmar (flipped class crchange of Interrogences, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onyms and Homophes often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening Skills chniques of Effective thering ideas and in	gative and Assertive and Asser	6 5	Student various correct  Student vocabu accurat  Student effectiv identify  Student and ext informations	es will senter grammers will lary and els will re lister es will ract reaction u	accurar transformer type natical enhance duse we context demoning sking barread efflevant	tely orm es and errors. ee their words t. strate tills and criers.	1,2, 3 1,2, 3		
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Home Word Idiom Liste i. Wh ii. Ty iii. Un Read i. Tec ii. Ga text iii. Tl	mmar (flipped class crchange of Interrogences, Exclamatory inces) pes of Tenses ommon Errors bulary Development word substitution onlyms and Homophels often confused as and phrases ming Skills at its listening? pes of Listening inderstanding Listening Skills chniques of Effective thering ideas and ince SQ3R Techniques	gative and Assertive and Asser	6 5	Student various correct  Student vocabu accurat  Student effectiv identify  Student and ext informatechniq	es will senter grammers will lary are listen es will ract reation uue.	accurateransformer typenatical enhanced use we context demoning sking barread efflevant sing the	tely orm es and errors.  te their words t.  strate tills and triers.  fficiently e SQ3R	1,2, 3 1,2, 3		
I III IV	i. Interest Senter Sent	mmar (flipped class crchange of Interrogences, Exclamatory inces) pes of Tenses ommon Errors  bulary Development on Substitution Substitution Substitution Substitution Substitution Substitution Substitution Substitution Substitution of Effective thering ideas and in Substitution of Substitution of Effective Communication Substitution of Substitution of Effective Communication Substitution of Effective Communication of E	gative and Assertive and Asser	6 5 5	Student construction various correct  Student vocabu accurate  Student effective identify  Student and extrinformate techniques  Student stude	es will senter grammers will lary and ely in elisten es will ract relation unue.	accurar transformer type natical enhance duse we context demoning sking barread effective effect	tely orm es and errors.  te their words t.  strate tills and triers.  ficiently e SQ3R  vely	1,2, 3 1,2, 3		
I	i. Interest Senter Senter ii. Ty iii. Co Voca One Voca Home Word Idiom Liste i. Wh ii. Ty iii. Ur Read i. Tec ii. Ga text iii. Th Time i. Intr	mmar (flipped class crchange of Interrogences, Exclamatory inces) pes of Tenses ommon Errors bulary Development word substitution onlyms and Homophels often confused as and phrases ming Skills at its listening? pes of Listening inderstanding Listening Skills chniques of Effective thering ideas and ince SQ3R Techniques	gative and Assertive and Asser	6 5	Student various correct  Student vocabu accurat  Student effectiv identify  Student and ext informatechniq	es will senter grammers will lary and ely in control services will react relation unue.	accurateransformer typenatical enhanced use we context demoning sking barread effective sing the effective use the context of	tely orm es and errors.  te their words t.  strate tills and triers.  ficiently e SQ3R  vely	1,2, 3 1,2, 3		

	Management iii. Basic Tips to Maintain Time			
VI	Creation of LinkedIn Profile	6	Students will create a professional LinkedIn profile.	2, 3

#### **Textbooks:**

- T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2: Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- T3: Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- T4: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **Reference Books:**

- R1: Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- R2: Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- R3: Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- R4: Murphy, Raymond,.(2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English ,Cambridge University Press

#### **OTHER LEARNING RESOURCES:**

https://www.ef.com/wwen/english-resources/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Provide students with the ability to transform sentence types, utilize different tenses, and address common grammatical mistakes.	2,3,4,8				
2	Empower students to proficiently apply one-word substitutions, differentiate between homonyms and homophones, avoid frequently confused words, and incorporate idioms and phrases in their vocabulary.	2,3,4,8				
3	Assist students in comprehending the various aspects and types of listening, and in identifying and overcoming obstacles to effective listening.	2,3,4,8				
4	Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.	2,3,4,8				
5	Instruct students on the significance of time management and provide foundational strategies to manage their time efficiently.	2,3,4,8				

			SEMESTER – II							
Course	Title		CO-CURRICULAI	R AC	TIVI	ΓIES				
Course	code	24UBCC121R	Total credits: 0.5		T 0	P 0	S 2	R 0	0/F 0	0.5
Pre-req	uisite	Nil	Co-requisite				Nil			
Progra	mme	Bach	elor of Science in Food	, Nut	rition	and D	ieteti	cs		
Semes	ster	Spri	ng/ II semester of first	year	of the	progr	amm	e		
Cour Object	tives	through participation 2. Foster leadership questudents to take on leactivities. 3. To be aware of their	nterpersonal skills, emotion in diverse co-curricular allities and organizational eadership roles and manager role in society and contant and Teamwork Skills-S	actival skil age ev	rities.  Is by provents of the position of the	orovidi or proje	ing op ects w	portuni ithin co	ities for	r cular
CO	1	and communicate bette					•••			
CO	2	their time and stay org								
CO	3	think more critically.	Critical Thinking - Student							
CO	4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.  Encourage Social Responsibility and Civic Engagement - Students will become more								
CO	5		consibility and Civic Engo ociety and contribute po			Studer	ıts wil	l becor	ne mor	re
Unit- No.		Conte	nt		ntact our	Lea	arning	g Outco	ome	KL
I	interpmana creati and n respo engaş comp hobb devel work Asses reflect invol these with time, critic	shops to enhance students will include partition essays, journals, and vement in workshops are experiences, students v	skills, developing time onal skills, boosting ag, promoting physical araging social gement. They will ties, workshops, and their interests and and emotional and emotional are sionals will conduct atts' talents. Articipation in activities, and evaluations of their and events. Through will learn to work well fectively, manage their e creativity, think th, reduce stress, and		50	Enha as tea leade common critic Holis Supp social devel acade Build Creat to interpret Person Province expression as the common creat to the commo	ncing amwork riship, nunical thir stic Grooting I, and lopme emic leding Nating operact wors, are ssional Friding a ivity, session, oring pring	ation, a aking. owth: emotion physic nt alon earning etwork porturn with pend als. ulfillmon eavenues	nd onal, al gside s. s: hities hers, ent:	1,2

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Improve Interpersonal and Teamwork Skills- Students will learn to work well with others and communicate better.	2,3,4,8				
2	Develop Time Management and Organizational Skills - Students will learn to manage their time and stay organized.	2,3,4,8				
3	Boost Creativity and Critical Thinking - Students will enhance their creative abilities and think more critically.	2,3,4,8				
4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.	2,3,4,8				
5	Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.	2,3,4,8				

	SEMESTER – III										
Course Title	e		MICROBI								
Course code	e 24BSFD214R	Total credit		L	T	P	S	R	O/F	C	
		Total hours: 45		3	0	2	0		0	4	
Pre-requisit		Co-requisi		NI4	4:	0 D:	Ni				
Programme Semester		Bachelor of Science in Food, Nutrition & Dietetics Fall/ III semester of second year of the programme									
Semester			second ye	ai oi	the p	n ogi	aiiiiii	<u>e</u>			
Course	2 To know food co	<ol> <li>To know about microbiology.</li> <li>To know food contamination and spoilage.</li> </ol>									
Objectives	I	wledge of the morph	-	ssifica	ition,	and 1	ole v	irus aı	nd algae	<b>.</b>	
CO1	Discuss the history										
CO2	Describe the role as	nd importance of ba	cteria in fo	od m	icrob	iolog	y.				
CO3		phology, physiolog							ogy.		
CO4	I	urrence, classificati									
CO5	Acquire knowledge	e of the morphology		tion, a	and ro	ole of	algae	2.		1	
Unit-No.	Conte	nt	Contact Hour		Lea	arnin	g Ou	tcome	9	KL	
	Introduction & Histo										
	Microbiology-The the	3									
	Spontaneous generation			_			ic tern	ns	1,2		
	terminology, heterotro		related to microbiology								
	-	utotrophic nutrition, saprophytic olozoic, host culture, parasites									
	Bacteria - morpholog	_									
	growth curve, genera,	5	Lea	1,2							
	food microbiology		in food microbiology								
	Fungi - Morphology,	_	7		ngi in	1,2					
	classification, physiol	ogy & nutrition, morphology,	food microbiology					1,2			
	Virus- Occurrence,	5	Learning about role of virus in food microbiology								
	reproduction, classific Algae-Occurrence, mo			1000	ı mıcı	robio	logy				
	,	1 00									
		eproduction, importance, general rinciples of spoilage, fitness & refines,			Learning about role of algae in						
1	of food microorganism	5	food microbiology						1,2		
	affecting growth.										
	Study of equipments in	n a microbiology									
	lab										
	Preparation of laborate	•		Lea	rning	abou	t equi	pmen	ts		
	special media, cultivat	ion of bacteria,			_		oiolog	_		1.2	
	yeasts and molds Staining of bacteria: g	rom stoining		Lear	rning	abou	t prep	aratio	on of	1,2, 3,4	
	Staming of bacteria: gi	-	30				-	acteri			
	important molds and y			molds and yeasts in food items and diagnostic methods for identification of microorganisms							
	Demonstration of avai										
	methods and diagnosti	-									
	identification of micro	organisms or									
	their products.										

T1: Ray B. and Bhunia A. Fundamental Food Microbiology, CRC Press Fifth Edition, 2014

## **REFERENCE BOOKS:**

R1: Frazier, Westhoff, Vanitha N M, Food Microbiology, 5th Edition, 2014

## **OTHER LEARNING RESOURCES:**

https://www.researchgate.net/publication/358954675_introduction_history_and_development_of_microbiology

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Discuss the history of microbiology.	1,2					
2	Describe the role and importance of bacteria in food microbiology.	1,2					
3	Comprehend the morphology, physiology, and role of fungi in food microbiology.	1,2					
4	Understand the occurrence, classification, and diseases caused by viruses.	1,2					
5	Acquire knowledge of the morphology, classification, and role of algae.	1,2					

	SEI	MESTER – III						
Course Ti	tle NUT	RITIONAL BIO	CHEM	IISTRY				
Course co	de   24BSED213R	l credits: 4	L	T P	S	R	O/F	C
	Total ho	ours: 45T+30P	3	0 2	0	0	0	4
Pre-requis		-requisite	NI4*4	: 0 D	Ni			
Programi		Science in Food,						
Semeste		ester of second y					der	
Course Objective	2. To understand how this met food. 3. To assess fluid, electrolyte, management strategies durin	<ol> <li>To review about the different biochemical metabolism reaction of the body.</li> <li>To understand how this metabolism takes place in co-relation with the nutrients of the food.</li> <li>To assess fluid, electrolyte, and acid-base balance and to make informed clinical management strategies during imbalance</li> </ol>						
CO1	Discuss the basic metabolic re	•	•			. •		
CO2	Apply the knowledge of enzyr metabolic processes.							
CO3	Analyze the various classes of							
CO4	Demonstrate the ability to asset informed clinical management				e bala	nce a	nd to n	nake
CO5	Explain the importance and cli imbalances and disorders	nical manifestation	ons of h	normones	and t	heir a	ssociat	ed
Unit-No.	Content		ontact Hour	Lear	ning (	Outco	ome	KL
I	Carbohydrates-Definition, classiff Structure (linear) of Monosaccharic fructose and galactose; Disaccharic Maltose, lactose and sucrose; Poly Starch and glycogen. Metabolism- pathway, electron transport chain a oxidative phosphorylation. Metabolicarbohydrates: glycolysis and trical acid (TCA) cycle, HMP shunt.	de-Glucose, les- saccharides- Glycolytic and blism of	9	Learning about the structure and function of carbohydrates				1,2
П	Protein- Definition, classification physical properties, chemical proputilization. Metabolism of proteins Transamination, deamination, decurea cycle. Enzymes and co-enzym Definition, types, classification an affecting velocity of enzyme cataly reactions. Diagnostic value of service Creatinine kinase, Alkaline phosphatase, LDH, SGOT, SGPT, Lipase, Carbonican hydrase etc.	erties and s:- arboxylation, nes- d factors yzed am enzymes - natase, Acid	10	Learning about the structure and function of proteins				1,2
Ш	Lipids-Definition, classification a properties.  Metabolism- Oxidation and biosynfatty acids. Ketone bodies, ketoger ketosis.	thesis of	10	Learnin structur of lipid	re and			1,2
IV	Acid – base balance- Acid-base b normal health, definition of principles of buffers, major source	buffers,	Learning abo of fluids and electrolytes			ut the	e role	1,2

	produced in the body, physiological buffer system and role of different buffer systems.  Fluid and electrolyte balance-Distribution of fluids in the body, ECF, ICF, Water metabolism, dehydration. Maintenance in normal health.			
V	Hormones - Classification, general mode of action, hormones of Pituitary, Thyroid, Parathyroid, Adrenals, Reproductive Glands, Pancreas, hormonal disorders, counter regulatory hormones.	12	Learning about the classification and function of hormones	1,2
VI Practical	Identification of carbohydrates (Qualitative Tests) Identification of proteins (Qualitative Tests) To study general properties of the enzyme Urease & Achromatic time of salivary amylase. Estimation of glucose in urine by Benedict's methods Urine analysis - normal and abnormal constituents of urine.	30	Learning about analysis of carbohydrates Learning about analysis of proteins Learning about properties of enzymes Learning about analysis of glucose Learning about analysis of urine	1,2,3

T1: Deb. A C., Fundamental of Biochemistry, New Central Book Agency (P) Ltd, reprint 2004

## **REFERENCE BOOKS:**

R1: Pattabiraman. T.N. Concise text Book of Bio- Chemistry, 2nd edition, All India Publishers and Distributors, Regd., 1998.

R2: Ambika Shanmugam, Fundamentals of biochemistry for Medical students, Karthik printers, 7th edition, 1992.

## **OTHER LEARNING RESOURCES:**

https://www.ncbi.nlm.nih.gov/books/NBK557556/ https://dhingcollegeonline.co.in/attendence/classnotes/files/1603564542.pdf

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Discuss the basic metabolic reaction of the body.	1					
2	Apply the knowledge of enzymes in terms of their structure, classification, properties and metabolic processes.	1,8					
3	Analyze the various classes of lipids and correlate their catabolic and anabolic pathways	1					
4	Demonstrate the ability to assess fluid, electrolyte, and acid-base balance and to make informed clinical management strategies during imbalance.	1,2					
5	Explain the importance and clinical manifestations of hormones and their associated imbalances and disorders	1					

	SEMESTER – III									
Course Ti	itle	FOOD TECH		.OG\	′ I					
Course co	ode 24BSFD212R	Total credits: 4	L	T	P	S	R	O/F	C	
		Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-requis		1								
Programi		Bachelor of Science Food, Nutrition & Dietetics								
Semeste		Fall/ III semester of second year of the programme								
Course	· I	1. To know about processing of cereals, pulses, oilseeds, fruits and vegetables, meat etc.								
Objective	2. To know about	2. To know about preservation of various foods.								
	3. To learn about j	post-mortem changes in meat								
CO1		rocessing technology and con								
CO2		ssing technology and compos		•						
CO3		ge about the processing and q								
CO4		assification and post-harvest								
CO5	Analyze the post-i	nortem changes in meat and	_			ation	metho	as.		
Unit-No.		Content		ntac Iour	Learning Outcome			itcome	KL	
	Cereal & Millets: Pro	_								
	Composition and uses									
I	coarse cereals, Process of malting, Gelatinization									
	of starch, types of browning. Rice-Composition of						g abou			
	ice obtained by different dehusking methods,			9	stı	1,2				
		nilling of rice, by-products of rice milling,			pr					
		Processing-Milling, polishing, parboiling, flaking,			an	ıd mill	ets			
		arching, roasting. Millets-Varieties, composition								
		nd uses of maize, sorghum, barley, rye, oats,								
	•	ticale, pearl millet and finger millet.  ulses & Legumes: Milling of legumes,								
		0 0								
	processing of pulses-se	g and fermentation. Toxic			I a	ornin	g abou	ı <b>+</b>		
		~					_			
II	· •	constituents in pulses and its detoxification processes. New improved technologies of legume				structure, use and processing of pulses and legumes				
		rocessing- canning, quick cooking legumes,								
		nstant legume powder, legume protein					iiiies			
	concentrates	i, iogumio provom								
	Fats and Oils - Metho	ods of oil extraction,								
	refining of oil, types-									
	refining, bleaching, st	_			Le	earnin	g abou	ıt		
***	hydrogenation, winter	rization, randomization/	processing and						1.2	
III	•	ncidity - hydrolytic and		13	1 ~		attribu		1,2	
		exidative rancidity and its prevention. Define -			_	ts and				
	margarine, butter, hyd	rogenated vegetable oil,								
	lard.									
	Fruits and Vegetable									
		and vegetables, general					g abou			
	•	ic browning, names and			_	-	attribu		1,2	
IV		ost harvest change in fruits		10	1					
	_	ateric rise, horticultural				of fruits and				
		l maturity, physiological	vegetables			les				
	changes, physical char	nges, chemical changes,								

	pathological changes during the storage of fruits			
	and vegetables.			
V	Meat - post mortem changes, ageing of meat, tenderizing meat, storage & preservation of meat, cuts & grades of meat.  Fish-preservation of fish-drying, curing, brining, fermentation.  Poultry- Preservation of eggs, egg powder, frozen eggs.	12	Learning about quality attributes and preservation methods of meat, fish and poultry	1,2
VI Practical	Market survey on processed foods Introduction to laboratory Instrutments/equipments Development of processed cereal products Development of processed pulse products Development of processed product from meat and fish	30	Learning about the availability of different processed foods in the market equipments used for processing and preservation.	1,2,3,4

T1: Rahman, M. S., Handbook of Food Preservation. MARCELDEKKER Inc. 1999

#### **REFERENCE BOOKS:**

R1: James G. Brennan, Food Processing Handbook, 2011

## OTHER LEARNING RESOURCES:

https://www.fssai.gov.in/upload/uploadfiles/files/Manual_Meat_Fish_09_01_2017(1).pdf
https://www.pfndai.org/Document/Association_News/dairy_processing/Dairy_Products_Processing_Dr_Kanade.pdf

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Learn about the processing technology and composition of cereals and millet.	1						
2	Explain the processing technology and composition of pulses and legumes.	1						
3	Acquire knowledge about the processing and quality attributes of fats and oils.	1						
4	Learn about the classification and post-harvest changes in fruits and vegetables.	1,8						
5	Analyze the post-mortem changes in meat and various preservation methods.	1,2						

	SEMESTER – III											
Course	Title	TECHNO PROF	ESSIONAL COURSE	I (TE	ECHN	NIQUE	S OF	PRESI	ERVATIO	N)		
Course	codo	24BSFD214R	Total credits: 1	L	T	P	S	R	O/F	C		
Course	coue	24DSF D214K	Total credits. 1	0	0	0	4	0	0	1		
Pre-requ	uisite	Nil	Co-requisite				N					
Prograi	mme	Bachelor of Science in Food, Nutrition & Dietetics										
Semes	ter		Fall/ III semester of second year of the programme III									
Cour	250		portance and need of pro									
Object			nciples and process of p		ation	•						
Ů			ferent preservation meth									
CO			ith practical knowledge					_				
CO2		_	rstanding of the principl				_		techniques	S.		
CO3			To enhance food safety and hygiene practices during food preservation.									
CO ₄		To promote the utilization of locally available resources for food preservation.										
COS	5	To foster entrepreneurial skills related to food preservation.										
Unit-		Content			tact	Learning Outcome						
No.				Но	ur					KL		
		ls-on training in vario	us preservation			To learn and understand the						
I		niques.		8	3	chronology of food processing						
	Tradi	itional Preservation N	lethods			and preservation						
	Dem	onstration and practic	e of food hygiene and			To lear		1,2				
II		y practices		10	10		preservation method and its					
						princip	al					
		aration of preserved for			To lear	n the o	lifferei	nt process				
III		neys and Sauces/ketch	•	12	2				icable in	1,2		
	_	essing, potato process	•			fruits a						
	Valu	able Products from ve	egetables.									
	<u>.</u>		1 1 .					•	oment and	1.0		
IV	Packaging and labeling of preserved products		10		d product	1,2						
						of vege		1 .				
V	Mocl	k food stalls and mark	tet simulations	12	2	To lear		_		1,2		
	Wiock food stans and market simulations				selling the products in market 1,2							

T1: Desrosier, N. W. and Desrosier, J. N. (1987). The Technology of Food Preservation. CBS Publishers and Distributors, New Delhi

#### **REFERENCE BOOKS:**

R1: Srivastava, R. P. and Kumar, S. (1998). Fruit and Vegetable preservation – Principles and practices. CBS Publishers and Distributors, New Delhi

## OTHER LEARNING RESOURCES:

 $\underline{https://actascientific.com/ASNH/pdf/ASNH-03-0529.pdf}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	To equip learners with practical knowledge and skills in various food preservation methods.	1,8					
2	To develop an understanding of the principles behind different preservation techniques.	1,2,6,8					
3	To enhance food safety and hygiene practices during food preservation.	1,2,6					
4	To promote the utilization of locally available resources for food preservation.	1,6					
5	To foster entrepreneurial skills related to food preservation.	1,6					

	SEMESTER – III									
Course	Title	E	NGLISH LANGU	JAGE FO	R EXC	ELLE	NCE			
Course	e code	24UBPD212R	Total credits:		T	P	S	R	O/F	C
			Total hours: 60	OP 0	0	4	0	0	0	2
Pre-rec		Nil	Co-requisite				Nil			
Progra			helor of Science in							
Seme	ester		I/ III semester of s			e prog	ramm	e		
Cou	rse	1.To understand and	11		ely.					
Objec	tives	2. To develop clear ar		ig skills.						
		3.To cultivate self-market Enable students to us		stmiet sime	10 000	nnlov d	and ac	<b>2010</b>	d conton	200
CC	)1	and distinguish between		_	oie, con	ipiex, a	illu co	проин	u semen	ices,
		Teach students the ba			amhio	iity w	rite na	raoranh	s and le	tters
CC	)2	and prepare resumes	~	w to avoid	amoige	11ty, W	ne pai	agrapn	is and ic	шт,
		Help students conduc		practice se	elf-regu	lation.	and m	aintain	persona	a1
CC	)3	hygiene.	i z z i mimijece,	Process 5		,			Personi	
		Equip students with k	nowledge about no	on-verbal o	commu	nication	ı, type	s of bo	dy	
CC	)4	language, and their in					, , ,		•	
CC	15	Train students in plan	nning and conducting	ng group d	iscussio	ons, eff	ective	ly disag	greeing,	and
	<i>)</i> 5	summarizing to attain	objectives.							
CC	)6	Prepare students for p					_			7
		telephone interview e	tiquettes, and adhe		code a	nd groo	oming	standar	rds.	
Unit-		Content		Contact		Learn	ing O	utcome	e	KL
No.				Hour	C ₄ 1					
	Gram	ımar (Flipped classro	oom)		Students will correctly use					
I	i. Use	of Prepositions		6	prepositions, create various sentence structures, and convert 2,					
1		nple, complex, compor		0	between active and passive					
	iii. Ac	ctive and Passive Voice		voice.						
	Writi	ng Skills	ng Skills							
	1	_								
		e Basics of Writing; av	oid ambiguity and		Ctudo		l *******	alaam a	d	
п	vag	e Basics of Writing; av gueness	oid ambiguity and					clear a		3 1
II	ii. Par	gueness ragraph Writing	oid ambiguity and	6	struct	ured pa	ragrap	hs, lett	ers,	3, 4
II	ii. Par	gueness ragraph Writing tter Writing			struct	ured pa	ragrap		ers,	3, 4
II	ii. Par iii. Let iv. Res	gueness ragraph Writing tter Writing sume and Cover Letter			struct resum	ured pa	ragrap I cover	ohs, lett letters	ers,	3, 4
II	ii. Par iii. Let iv. Res Self-N	gueness ragraph Writing tter Writing sume and Cover Letter Management Skills			struct resum Stude	ured pa	ragrap l cover	ohs, lett letters	ers,	3, 4
III	ii. Par iii. Let iv. Res Self-N i. SW	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis			structi resum Stude analys	nts will	ragrap l cover l perfo f-regul	ohs, lett letters orm SW late, and	ers, OT d	3, 4
	ii. Par iii. Let iv. Res Self-M i. SW	gueness ragraph Writing tter Writing sume and Cover Letter Management Skills OT Analysis f-Regulation		6	Stude analys	nts will ses, sel	ragrap l cover l perfo f-regul	ohs, lett letters	ers, OT d	
	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe	gueness ragraph Writing tter Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene	<u>.</u>	6	structi resum Stude analys	nts will ses, sel	ragrap l cover l perfo f-regul	ohs, lett letters orm SW late, and	ers, OT d	
	ii. Par iii. Let iv. Res Self-N i. SW ii. Sel iii. Pe	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati	<u>.</u>	6	Stude analys adher	nts will ses, sel to per	ragrap l cover l perfo f-regul rsonal	ohs, letters orm SW late, and	ers, OT d	
III	ii. Par iii. Let iv. Res Self-N i. SW ii. Sel iii. Pe Non- Body	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language	ion-Sciences of	5	Stude analys adhere practi	nts will ses, sel e to per ces.	l cover	ohs, letters references references references	OT d e	3, 4
	ii. Par iii. Let iv. Res Self-N i. SW ii. Sel iii. Pe Non- Body i. Wha	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language at is Non-Verbal Communicati	ion-Sciences of	6	Stude analys adher practi	nts will sees, selfectores.	l cover l perfo f-regul rsonal	ohs, letters orm SW late, and	OT d e	
III	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe Non- Body i. Wha Body	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language	ion-Sciences of munication &	5	Stude analys adhere practi	nts will ses, sel e to per ces.	l perfo f-regul sonal	ohs, letters references references references	OT d e	3, 4
III	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe Non- Body i. Wha Body ii. Typ	gueness ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language at is Non-Verbal Communicati Language	ion-Sciences of munication &	5	Stude analys adhere practi	nts will ses, sel e to per ces.  Ints will ively u language.	l perfo f-regul sonal	ohs, letters references references references	OT d e	3, 4
III	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe Non- Body ii. Wha Body ii. Typ iii. Im	ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language at is Non-Verbal Communicati Language bes of Body Language	ion-Sciences of munication &	5	Stude analys adhere practi Stude effect body comm	nts will ses, sel e to per ces.  Ints will ively u language.	l perfo f-regul rsonal l under se diff ge in	ohs, letters orm SW late, and hygiend rstand a	OT d e	3, 4
III	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe Non- Body i. Wha Body ii. Typ iii. Im Group	ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language at is Non-Verbal Communicati Language pes of Body Language personal Impact of p Discussion uning and Elements of	ion-Sciences of munication & , of Body Language,	5	Stude analys adher practi  Stude effect body comm	nts will ses, selve to per ces.  Ints will ses, selve to per ces.  Ints will selve unication ints will sipate into the control of the control	l performant l performant l under see diffige in sion.	orm SW late, and a conditions of discussions and ordiscussions.	oT d e and vpes of	2, 3
III	ii. Par iii. Let iv. Res Self-M i. SW ii. Sel iii. Pe Non- Body i. Wha Body ii. Typ iii. Im Group i. Plar ii. Eff	ragraph Writing ster Writing sume and Cover Letter Management Skills OT Analysis f-Regulation rsonal Hygiene Verbal Communicati Language at is Non-Verbal Communicati Language pes of Body Language sportance and Impact of p Discussion	ion-Sciences of munication & f Body Language, Group Discussion	5	Stude analys adhere practi  Stude effect body comm  Stude partic disagn	nts will ses, selve to per ces.  Ints will ses, selve to per ces.  Ints will selve unication ints will sipate into the control of the control	l performance de la performance del performance de la performance del performance de la performance de	ohs, letters restand a serent ty and o discussively, ar	oT d e and vpes of	3, 4

VI	Interview Skills & Dress code Ethics  i. Personal Interview – Concept and Practice  ii. Common Interview Questions and  answering Strategies  iii. Telephone Interview Etiquettes  iv. Introduction to Dress Code and Grooming	5	Students will demonstrate effective interview techniques, answer common questions, follow telephone etiquettes, and dress appropriately.	2, 3
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- T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2: Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- T3: Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- T4: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

- R1: Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- R2: Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- R3: Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Ployercrest Press.
- R4: Murphy, Raymond, (2012) English Grammar in Use Book with Answers: A Self-Study and Practice Book for Intermediate Learners of English, Cambridge University Press

### **OTHER LEARNING RESOURCES:**

https://learning.shine.com/talenteconomy/career-help/top-group-discussionskills https://www.coursera.org/articles/conflict-management

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Enable students to use prepositions, construct simple, complex, and compound sentences, and distinguish between active and passive voice.	3,4,7,8						
2	Teach students the basics of writing, how to avoid ambiguity, write paragraphs and letters, and prepare resumes and cover letters.	3,4,7,8						
3	Help students conduct SWOT analyses, practice self-regulation, and maintain personal hygiene.	3,4,7,8						
4	Equip students with knowledge about non-verbal communication, types of body language, and their impact.	3,4,7,8						
5	Train students in planning and conducting group discussions, effectively disagreeing, and summarizing to attain objectives.	3,4,7,8						

			SEMEST	ER – III							
Cours	e Title		BASIC LIFE	SAVING	SKILL	S (BL	SS)				
Cours	e code	24UULS202R	Total credits:		T	P	S	R	O/F	C	
			Total hours: 3		0	0	0	0	0	2	
	quisite	Nil	Co-requisite				Nil				
	amme		achelor of Science								
Sem	Semester Fall/ III semester of second year of the programme										
	urse ctives	<ol> <li>The aim of the course is to provide the learners with basic knowledge and practical skills needed in an emergency fire situation.</li> <li>To provide appropriate basic management and treatment for injuries.</li> <li>To learn about the fire equipments requirements, methods of operation and getting out alive.</li> </ol>									
C	01	The students will be oxygen to the patie	ents to sustain tissu	ue viability							
CO		The students will be infants victims  The students will be pain and protecting	pe able to prevent i	injury from	getting	_					
CO	)4	Importance of physical									
CC	<b>D</b> 5	The students will be operation and getti	e able to learn abo	out the fire	equipme	ents re	quirem	ents, n	nethods	of	
Unit- No.		Content		Contact Hour		Learn	ing Ou	itcom	e	KL	
I	• Introd • Chair • ABC • CPR • AED	Life Support (BIS) duction of BLS n of survival s Assessment and Ventilation Tec ing for adult and ch	hnique	5	To acquire the knowledge and skills necessary to effectively perform cardiopulmonary resuscitation (CPR), use an automated external defibrillator (AED), and manage choking emergencies in adults and children within the context of the chain of survival.					1,2	
II		<b>Aid</b> en rules of First aid aid Kits		5	Golden the app	n Rule propria	nd and a s of Finate use gency s	st Aid	and st Aid	1,2	
Ш	• Intro- • Prior hospita • Scene • Prima • Bleec • Extri • Cervi-	e safety ary assessment ling control cation of victims and cal spine stabilizatio	d safe transfer n and C-collar	principles of initial trauma care, including scene safety, primary assessment, bleeding control, extrication techniques, cervical spine stabilization, and splinting of broken limbs, in pre-hospital					1,2		
IV	Triage system To understand the princ					S	1,2				

	Triage of Single and Multiple Casualties in Pre-Hospital setting		approach, and its application in assessing and prioritizing treatment for both single and multiple casualties in prehospital settings.	
V	Medical emergencies Introduction Victim centred approach and Management of:- • Seizures • heart attack • asthma • diabetic emergencies • emergency childbirth • Respiratory distress and failure	4	To understand the principles of victim-centered care and effectively manage medical emergencies including seizures, heart attacks, asthma, diabetic emergencies, emergency childbirth, and respiratory distress/failure.	1,2
VI	Environmental Emergency  • Recognizing and caring for heat related illness such as: Heat stroke,  • heat cramps, heat exhaustion, dehydration.  • Recognizing and caring for cold related illness such as frostbite,  • hypothermia.  • Poisoning, Snake bite.	3	To develop the ability to recognize and provide appropriate care for individuals suffering from heat-related illnesses (heat stroke, heat cramps, heat exhaustion, dehydration), cold-related illnesses (frostbite, hypothermia), poisoning, and snake bites in emergency situations.	1,2
VII	<ul> <li>Safety of people in the event of fire</li> <li>Recognition of possible fire sources and emergency procedures,</li> <li>Construction techniques for eliminating fire.</li> <li>Types of detecting devices and extinguishing agents and systems</li> <li>Devising procedures in the event of fire and react to fire danger.</li> <li>Safety goals and objectives, Identifying hazards and risks</li> </ul>	3	To develop the knowledge and skills necessary to ensure the safety of people and property by understanding fire sources, implementing fire prevention techniques, utilizing appropriate fire detection and suppression systems, and establishing effective emergency procedures.	1,2

## **REFERENCE BOOKS:**

R1: Nancy Caroline's Emergency Care in the streets eight edition by Jones and Bartlett

R2: First Aid book by LC Gupta; Publisher Jaypee Brothers, 7th Edition.

# **OTHER LEARNING RESOURCES:**

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	The students will be able to recognize respiratory arrest/ cardiac arrest, and provide oxygen to the patients to sustain tissue viability	1,8					
2	The students will be able to perform the importance of early CPR on Adult, child and infants victims	1,8					
3	The students will be able to prevent injury from getting worse, aiding recovery, relieving pain and protecting the victims from deterioration	1,8					
4	Importance of physiology in forestry	1,8					
5	The students will be able to learn about the fire equipments requirements, methods of operation and getting out alive.	1,8					

SEMESTER – III												
Course	e Title		PERSONAL FI						0.77	~		
Course	e code	24UUFL202R	Total credits: 2 Total hours: 30P	L	T	P	S	R	O/F	C		
Pro roc	nuicita	Nil	Co-requisite	0	0	2	0 Nil	0	0	2		
	re-requisite Nil Co-requisite Nil  Rogramme Bachelor of Science in Food, Nutrition and Dietetics											
Seme					ond year of the programme							
				approach to understand the relevant concepts of								
Cou Objec		<ul><li>2. Assess the person methods of goal a</li><li>3. Formulate a budg financial goals</li></ul>	money, borrowing, lending, taxes and their application to financial planning.  2. Assess the personal financial planning process, the life cycle of financial plans, and methods of goal achievement.  3. Formulate a budget, record-keeping system, and tax planning strategy based on current									
CC	)1	_	nagement strategy an	d a plan to	facili	tate th	e hom	ne or au	tomobile	;		
		buying process	1	.1 . 11			1 1:00					
CO	)2	Design a diversified objectives.	l investment portfolio	o that addr	esses	severa	ıı ditte	erent in	vestment			
СО	)3	Differentiate between direct or indirect real	en open- and closed- al estate investments	•		-						
СО	)4	and your estate.	lan that covers your									
CO	<b>)</b> 5	Formulate a budget financial goals	, record-keeping syst	em, and ta	x plar	nning	strateg	y based	l on curr	ent		
Unit- No.		Conten	t	Contact Hour		Lea	rning	Outco	ne	KL		
I	i. Fun ii. Infl contro iii. pro iv. Tin compo v. Net vi. Po	amentals of Financi ctions of money; lation- Meaning, caus olled; occess official plannin me value of money-s ound interest; a Present Value and F wer of Compounding oubling period and R	ses, how it can be g, imple and future value, g;	6	con the imp prin plan mon inte valu con dou 72.	cepts of function act of aciples ming, ney (si rest, No., the npound bling	of fina ons of inflat s of fin the tin imple NPV, a e poweding, a period	money, ince, income, the cancial me value and corund futuer of and the cand	e of npound re ule of	1,2		
П	i. Mea ii. Dir variou iii. No iv. Ta v. GS	ns heads of Income for on-taxable Income, on evasion and tax avoing T, Tax Planning Stra	f Income, indirect Taxes, Taxable Income, s of Income for tax Calculation, ble Income, on and tax avoidance, Planning Strategies  Income, direct and indirect taxes, taxable and non-taxable income, explore tax evasion and avoidance, and learn to apply various tax planning strategies within the framework of GST.						1,2			
III	Entrepreneurial planning –  i. Meaning of Entrepreneurship, prerequisites  for becoming an entrepreneur  To understand the concept of entrepreneurship, its  prerequisites and to analyze						alyze tems uding	1,2				

	iv. Financial support systems for		financial institutions, venture	
	entrepreneurs;		capital, and angel investors,	
	v. Venture Capital, Business Angels,		for successful entrepreneurial	
	vi. Assistant of Government,		ventures.	
	vii. Commercial Bank Loans and Overdraft.			
	Planning for investing in securities market i. Investment avenues offered by Securities			
	Markets, Primary Market and Secondary			
	Market,			
	ii. Stock market- meaning, features, functions			
			T1	
	of NSE, BSE DEMAT trading account,		To understand and evaluate	
	iii. Security repository, stock brokers,		investment avenues in the	
	Operational aspects of securities markets:		securities market, including	
	placement of orders, contract note, pay-in and		stock markets, mutual funds,	
IV	pay-out, trading and settlement cycle,	6	and their operational aspects,	1,2
1	iv. Various risks involved in investing in		while identifying and	1,2
	securities markets; Role of Financial		mitigating associated risks	
	Intermediaries;		through knowledge of	
	Stock indices.		financial intermediaries and	
	v. Mutual Funds- meaning concept,		investment strategies like SIP.	
	definition, types, importance and drawbacks			
	of mutual funds, mutual funds in India,			
	investing in mutual funds,			
	vi. Systematic Investment Plan (SIP) and its			
	advantages.			
	Planning for debts and Retirement		T 1 1 1 1	
	i. Consumer credit - Introduction to consumer		To develop a comprehensive	
	credit; choosing a source of credit, the cost of		understanding of financial	
	credit alternatives,		planning principles, including	
	ii. Consumer Legal Protection;		consumer credit management,	
	iii. Housing Decision: Factors and Finance;		housing and vehicle financing,	
V	Vehicle Decisions.	6	retirement planning strategies	1,2
	iv. Retirement planning - Meaning of cost of	-	(including need analysis,	
	living; retirement need analysis; development		investment options, and	
	of retirement plan, various retirement		retirement schemes), and	
	schemes.		estate planning considerations	
			(including pension, Medicare,	
	C.		and wills).	
	v. Estate Planning; Pension and Medicare Planning; Wills.		and wills).	

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Develop a cash management strategy and a plan to facilitate the home or automobile buying process	7,8						
2	Design a diversified investment portfolio that addresses several different investment objectives.	7,8						
3	Differentiate between open- and closed-end mutual funds, exchange-traded funds, and direct or indirect real estate investments.	7,8						
4	Create a financial plan that covers your income needs in retirement and helps protect you and your estate.	7,8						
5	Formulate a budget, record-keeping system, and tax planning strategy based on current financial goals	7,8						

			SEMESTER – 1	III						
Course	Γitle	RURAL S	OCIOLOGY AND GENDI	ER IN	CLUS	ION I	N AG	RIC	ULTUR	E
Course	code	24BSFD201R	Total credits: 3	L	T	P	S	R	O/F	C
			Total hours: 45T	3	0	0	0	0	0	3
Pre-requ		Nil	Co-requisite : F	1 17	. ••	1	Nil	•		
Programme Bachelor of Science in Food, Nutrition and Dietetics										
Semest	emester Fall/ III semester of second year of the programme  1.To know the intricate relationship between rural societies, gender dynamics, and									
		agricultural p	•	ı rural	societi	es, ge	nder d	ynam	ics, and	
Cours			actices. e social, economic, and cultu	ral fac	tora th	at aha	20 41140	1	amunitia	a xxiith
		•	cus on gender roles, inequal			•		ii con	mumme	s, willi
Objecti	ves	-	the impact of government p		_			***	ome on i	
			particularly women farmers		and d	evelop	mem	progr	ams on i	rurai
			complex social structures an		utions	in mir	al ara	og ind	dudina	
CO1			kinship systems.	u msm	unons	III I UI	ai ai ca	18, 1110	nuanig	
			litional and evolving gender	roles	nd rel	ations	in mir	al soc	ieties	
CO2		particularly in a		TOICS a	iliu i cia	ations	III I UI	ai soc	ictics,	
		1	<u> </u>	ased in	egnali	ties nr	evaler	nt in		
CO3		Identify and critically examine the gender-based inequalities prevalent in rural areas, including access to resources, decision-making power, and								
		opportunities.								
		* *	s rural development theories	and pr	actices	s. with	a foc	us on	gender-	
CO4		sensitive approa	=	ana pi		,			8-111	
			ct of government policies an	d deve	lopme	nt pro	grams	on ru	ıral	
CO5		_	articularly women farmers.		•	•	C			
Unit-			•	Co	ntact	т.	•	- 0-	4	IZI
No.		,	Content	Н	lour	Le	earnin	ıg Ou	tcome	KL
	Soci	ology and Rura	I sociology: Definition and			To le	earn a	bout		
I	scop	e, its significance		10	sociology and rural				1,2	
		al society.					ology			
		_	al Stratification, Culture			To learn about Social			Social	
II		_	ution, Social Change &		7		ıps, S			1,2
		elopment					ificati			
			nal Status of Women in				iscuss			
III	_	•	Causes for Poor Health and		10				itional	1,2
			nong Rural Women, Effects				ıs of V		n in	
		oor Health & Nu				Agrı	cultur	e		
			in Agriculture & Allied			 	•	. 1	4 4 <b>1</b> .	
			nen in Crop production, Post				iscuss			
IV		•	k, Fisheries, Forestry		10				men in	1,2
		-	Rural Production and			_	cultur	e & P	Alliea	
	F000	d Security				Sect	OIS			
	Stat	us Of Women in	Rural Families: Measures			Tod	iscuss	ahou	t the	
V			and economic status of rura		8		is of V			1,2
•	won	-	and evolioning butter of full		3		ıl Fam			1,2
L	., 511	**				11010	4111			

T1: Norman N. Potter and Joseph H. Hotchkiss, Food Science, CBS publishers and distributors, Fifth edition, 2000

### **REFERENCE BOOKS:**

R1: Manay Shakunthala, Nand Shadaksharaswamy M. Foods facts and Principles, New Age International (P) Ltd Publishers, Reprint 2005.

R2: Srilakshmi B. Food Science, New Age International (P) Ltd Publishers, Third edition, 2005.

### **OTHER LEARNING RESOURCES:**

https://raubikaner.org/wp-content/themes/theme2/PDF/AGEXT-111.pdf

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the complex social structures and institutions in rural areas, including caste, class, and kinship systems.	1,2					
2	Analyze the traditional and evolving gender roles and relations in rural societies, particularly in agriculture.	1,2					
3	Identify and critically examine the gender- based in equalities prevalent in rural areas, including access to resources, decision-making power, and opportunities.	1,2,4					
4	Evaluate various rural development theories and practices, with a focus on gender-sensitive approaches.	1,2					
5	Assess the impact of government policies and development programs on rural communities, particularly women farmers.	1,2,7					

			SEMESTER – III							
Course T	itle		CO-CURRICUL	AR ACT	TIVIT	IES				
Course c	ode	24UBCC211R	Total credits: 0.5	L	T	P	S	R	O/F	C
				0	0	0	2	0	0	0.5
Pre-requi		Nil	Co-requisite	- 1 N4	•4•		Nil			
Program		Bachelor of Science in Food, Nutrition and Dietetics								
Semest	er	Fall/ III semester of second year of the programme  1. Develop students' interpersonal skills, emotional intelligence, and teamwork abilities								
Cours Objectiv	_	through particip 2. Foster leadershi students to take	ation in diverse co-curricup qualities and organization on leadership roles and or projects within co-curri	ılar activ onal skill	ities. s by pı	ovidin				
CO1		Improve Interpersonand communicate l	onal and Teamwork Skills	- Student	s will	learn t				
CO2		their time and stay Boost Creativity ar think more critical	organized. nd Critical Thinking - Stud ly.	lents wil	l enhai	nce the	eir cre	ative	abilitie	s and
CO4		Promote Physical and Mental Health - Students will improve their overall health and reduce stress.  Encourage Social Responsibility and Civic Engagement - Students will become more								
CO5		_	Responsibility and Civic E in society and contribute	positivel	y.	tudent	s will	beco	me mor	e
Unit- No.		Cor	ntent	Contac Hour	t	Learr	ning (	Outco	me	KL
I	Based on the learner's interest improving interpersonal and to developing time management organizational skills, boosting critical thinking, promoting phealth, and encouraging social and civic engagement. They were regular club activities, works competitions that align with thobbies, fostering their social development. Renowned professed conduct workshops to enhance Assessments will include paractivities, reflection essays, job evaluations of their involvem and events. Through these exwill learn to work well with communicate effectively, man stay organized, enhance creat critically, improve their healt		l and teamwork skills, ement and posting creativity and ting physical and mental a social responsibility. They will engage in workshops, and with their interests and social and emotional d professionals will enhance students' talents. The participation in ays, journals, and polyement in workshops ese experiences, students with others, y, manage their time, e creativity, think	60	de cul tea ma org wh cri ser res engact	foster velopn ltivatin mwork magen ganizat tical th nse of s sponsib gaging civities entorsh nowned	nent bag intek, timent, a cional rturing inkin social bility textra, worlip fro	y erpers e and skills g crea g, and through curric sshop m	s, ativity, d a gh cular es, and	1,2

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Improve Interpersonal and Teamwork Skills- Students will learn to work well with others and communicate better.	3,4,7,8						
2	Develop Time Management and Organizational Skills - Students will learn to manage their time and stay organized.	3,4,7,8						
3	Boost Creativity and Critical Thinking - Students will enhance their creative abilities and think more critically.	3,4,7,8						
4	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.	3,4,7,8						
5	Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.	3,4,7,8						

			SEMESTER	R IV							
Course	Title	INST	ITUTIONAL FOO	D SER	VIC	E MAI	NAGE	MENT			
Course	code	24BSFD211R	Total credits: 2	L	T	P	S	R	O/F	C	
			Total hours: 30T	2	0	0	0	0	0	2	
Pre-requ		Nil	Co-requisite	<u> </u>				lil			
Progran		Bachelor of Science in Food, Nutrition & Dietetics  Spring/ IV semester of second year of the programme									
Semest	ter	_			•			amme			
Cours	se		. To introduce with catering industry and food service system To know about principles, tools and techniques of management.								
Objecti	ives	3. To apply the knowl	•	-		_		in a fac	d compies	unit	
CO1		* * *		_						unn	
COI		· ·	Classify the food service system its components, and assess their functions.  Acquire knowledge of floor planning, layout characteristics, and equipment necessary								
CO2		for food service facilities.									
CO3		Develop a menu plan		dize dif	fere	nt recin	es.				
CO4		Explain the food serv				Т					
CO5		Apply the knowledge			mana	agemen	t in a f	ood ser	vice unit		
Unit-			_	Conta		_					
No.		Conten	t	Hou	r	L	earnin	g Outco	ome	KL	
	Cate	ering industry-Definit	ion of catering.								
	Clas	sification of food servi	ice institutions								
	acco	ording to									
I		function: Profit oriented, service oriented									
		public health facility oriented.				Learning about functioning 1.					
		ocessing method: Con	*	9		of food service institutions					
		missary system and fas	st food service								
	syste										
		rice of food: Self service									
		waiter-waitress service									
		or planning and layou									
		rpical food service faci of work areas-Receiving									
		aration, cooking, servi	-								
		washing, pot and pan v					_	ut divisi			
П		age disposal: flow space	-					f worki	ng	1,2	
	_	king heights and dimen	-	10				service		1,2	
	cente					institut	ions				
	Equi	ipment-Classification,	factors involved								
	_	election, use and care o									
		pment.	-								
	Qua	ntity food preparatio	n-Selection,								
	purc	hasing methods and sto	orage of foods.								
	Men	u planning – Definition	n, principles								
	invo	lved in planning and ty	pes of menus.			Learni	na aho	ut menu			
III		dardization of recipe -		13			-	quality		1,2	
		dard recipe format and		13		Limitin	₅ und	Jaminy			
		dard portion sizes-Def									
		pments and portion co	ntrol. Use of left								
		foods				т .		, .			
IV		nagement-Definition, p	-	4.5			_	ut runni	-	1,2	
	tech	niques of effective man	nagement.	10		Iood in	ıstıtutı	on in an			

	Tools of management-Organization chart, work study and work improvement. Use of computers in food service establishments.		organized manner	
V	Financial management-Principles and methods of food cost control, factors affecting food cost, labor cost, operating cost and over head cost.  Personnel management-Methods of selection, orientation, training, supervision and motivation of employees.	12	Learning about financial management while running a food service institution	1,2

T1: Sethi M., Catering Management: An Integrated Approach. New Age International (P) Ltd, Publishers, Third edition, 2015.

#### **REFERENCE BOOKS:**

R1: Sethi M., Institutional Food Management. New Age International (P) Ltd, Publishers, Third edition, 2008.

## **OTHER LEARNING RESOURCES:**

 $\frac{https://ebooks.inflibnet.ac.in/hsp05/chapter/classification-and-objectives-of-the-food-service/https://egyankosh.ac.in/bitstream/123456789/33522/3/Unit-12.pdf$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Classify the food service system its components, and assess their functions.	1						
2	Acquire knowledge of floor planning, layout characteristics, and equipment necessary for food service facilities.	1						
3	Develop a menu plan and learn to standardize different recipes.	1						
4	Explain the food service management system	1						
5	Apply the knowledge of financial and personnel management in a food service unit	1,2,8						

Course code   24BSFD222R   Total credits: 4   La T   P   S   R   O/F   C				SEMESTER	IV								
Pre-requisite   Nil   Co-requisite   Course	Course 7	Title		ADVANC	E DIETI	ETICS	5						
Total hours: 45T+30P   3   0   2   0   0   0   4	Course	ode	24RSFD222R	Total credits: 4	L	T	P	S	R	O/F	C		
Semester   Spring/IV semester of second year of the programme   Semester   Spring/IV semester of second year of the programme   2. To study about the different metabolic and systemic diseases and nutrient drug interactions.   2. To study about the different nutrient modification at different disease state.   2. To acquire knowledge of therapeutic medications for specific diet   Learn and discuss the different aspect of dictician in healthcare sector. Acquire the knowledge of the relationship of dictician with health and develop skills required in Nutritional counseling   Nutritional counseling   CO2	Course	out	24DSF D222K	Total hours: 45T+30	)P 3	0	2		, ,	0	4		
Semester   Spring/IV semester of second year of the programme				_									
Course Objectives													
Objectives  2. To study about the different nutrient modification at different disease state. 3. To acquire knowledge of therapeutic medications for specific diet  Learn and discuss the different aspect of dietician in healthcare sector. Acquire the knowledge of the relationship of dietician with health and develop skills required in Nutritional counseling  CO2 Learn and apply adaptation of therapeutic diets in different disease state  CO3 Acquired knowledge on nutritional management in infections and fever  CO4 Apply the importance of therapeutic diet in cardiovascular disease, diabetes and gout.  CO5 Evaluate the significance in the modifications of diet in gastrointestinal diseases.  Understand different Malabsorption Syndrome  Unit-No.  Content  CO6 Contact Hour  I Content  Learning Outcome  KL  Learn the importance of application of therapeutic diet in different conditions.  I Content  Learn the importance of application of therapeutic diet in different cardiovascular disease.  Understand and describe different cardiovascular disease ondition of the patient on different cardiovascular disease ondition of the patient on different cardiovascular disease ondition of the patient on different disease on diff	Semest	er											
Columber	Cours	se											
Learn and discuss the different aspect of dictician in healthcare sector. Acquire the knowledge of the relationship of dictician with health and develop skills required in Nutritional counseling			•						ase state	<b>e</b> .			
Rowledge of the relationship of detician with health and develop skills required in Nutritional counseling   CO2	3		· · · · · · · · · · · · · · · · · · ·										
Nutritional counseling	CO1												
CO2   Learn and apply adaptation of therapeutic diets in different disease state	COI												
CO3	CO2				diata in a	liffara	nt dia	2000 01	rata				
CO4   Apply the importance of therapeutic diet in cardiovascular disease, diabetes and gout.													
Evaluate the significance in the modifications of diet in gastrointestinal diseases. Understand different Malabsorption Syndrome    Unit-No.   Content   Contact Hour   Learning Outcome   KL										and gov	ıt		
Unit-No.  Nutritional care for metabolic disorders-Diabetes mellitus: Types, etiology, symptoms, metabolic changes and dietary management. Gout, phenylketonuria, lactose intolerance, hypo and hyper thyroidism-Causes, symptoms and dietary management.  Nutritional care for diseases of cardiovascular systems-Hypertension, hyperlipidaemia, atherosclerosis, coronary heart disease, congestive heart failure: Etiology, symptoms and dietary management. Relationship between dietary fat and development of cardiovascular diseases.  Nutritional care for diseases of kidney and urinary tract- Nephritis, nephritic syndrome, nephrolithiasis, renal failure: Etiology, symptoms, dietary management and renal dialysis.  Nutritional care for cancer and aids: Causative and risk factors, chronic complications, different stages of both the disorders, dietary modifications, food to be included and foods to be avoided.  Food Allergy – Diagnosis and treatment. Surgery, trauma and burns- Physiological changes, nutritional care and management. Use of food exchange list in diet planning.  Viscopting the diet according to the disease condition and nutritional requirement of the patient  Learn the importance of application of therapeutic diet in different conditions.  10  Learn the importance of application of therapeutic diet in different conditions.  11,2  Understand and describe different renal disease condition of the patient  Understand and describe different renal diseases and modify the diet according to the disease condition of the patient  Develops the skills to use the knowledge of modifying the diet according to the disease condition of the patient  Develops the skills to use the knowledge of modifying the diet according to the disease condition of the patient	004												
Nutritional care for metabolic disorders-Diabetes mellitus: Types, etiology, symptoms, metabolic changes and dietary management. Gout, phenylketonuria, lactose intolerance, hypo and hyper thyroidism-Causes, symptoms and dietary management.   Nutritional care for diseases of cardiovascular systems-Hypertension, hyperlipidaemia, atherosclerosis, coronary heart disease, congestive heart failure: Etiology, symptoms and dietary management. Relationship between dietary fat and development of cardiovascular diseases.   Nutritional care for diseases of kidney and urinary tract- Nephritis, nephritic syndrome, nephrolithiasis, renal failure: Etiology, symptoms, dietary management and renal dialysis.   Nutritional care for cancer and aids: Causative and risk factors, chronic complications, different stages of both the disorders, dietary modifications, food to be included and foods to be avoided.   Too Allergy - Diagnosis and treatment. Surgery, trauma and burns- Physiological changes, nutritional care and management. Use of food exchange list in diet planning.   Learn the importance of application of therapeutic diet in different conditions.   1.2	CO5					Ct III g	asiro	mesu	iai disc	ascs.			
No.   Content	Unit-					:			_				
Nutritional care for metabolic disorders- Diabetes mellitus: Types, etiology, symptoms, metabolic changes and dietary management. Gout, phenylketonuria, lactose intolerance, hypo and hyper thyroidism-Causes, symptoms and dietary management.  Nutritional care for diseases of cardiovascular systems-Hypertension, hyperlipidaemia, atherosclerosis, coronary heart disease, congestive heart failure: Etiology, symptoms and dietary management. Relationship between dietary fat and development of cardiovascular diseases.  Nutritional care for diseases of kidney and urinary tract- Nephritis, nephritic syndrome, nephrolithiasis, renal failure: Etiology, symptoms, dietary management and renal dialysis.  Nutritional care for cancer and aids: Causative and risk factors, chronic complications, different stages of both the disorders, dietary modifications, food to be included and foods to be avoided.  Food Allergy – Diagnosis and treatment. Surgery, trauma and burns- Physiological changes, nutritional care and management. Use of food exchange list in diet planning.  It is a learn the importance of application of therapeutic diet in different conditions.  10 application of therapeutic diet in different conditions.  12 Understand and describe different cardiovascular disease and modify the diet according to the disease condition of the patient  Understand and describe different renal diseases and modify the diet according to the disease condition of the patient  12 Develops the skills to use the knowledge of modifying the diet according to the disease condition of the patient  13 Develops the skills to use the knowledge of modifying the diet according to the disease condition and modify the diet according to the disease condition and nutritional requirement of the patient	1		Con	itent			Lea	rning	Outcon	ne	KL		
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Use of food exchange list in diet planning.  nutritional requirement of the patient							-			_			
Use of food exchange list in diet planning.  the patient		char	nges, nutritional car	e and management.									
		Use	of food exchange l	ist in diet planning.					i U1				
V Nutritional care in eating disorders: Dietary 8 Describe the term dietician 1,2					line								
	V	Nuti	ritional care in eatir	ng disorders: Dietary	8	Des	scribe	the te	rm dieti	cian	1,2		

	treatment and other recommendation, addictive behavior in anorexia nervosa, bulimia & alcoholism. Nutrient drug interaction.  Patient education and counseling- Assessment of patient needs, establishing rapport, counseling relationship, resources and aids to counseling.		and different roles played. Understand the relationship of dietician with health and develop skills required in nutritional counseling	
VI Practical	Planning, preparation and calculation of diets for insulin dependent Diabetes mellitus.  Planning snacks, desserts and beverages for diabetes.  Planning, preparation and calculation of diet in cardio vascular diseases.  Planning, preparation and calculation of diet in kidney failure, kidney transplant, renal complication and kidney stones.  Planning, preparation and calculation of diet in cancer.	30	Understand, apply and assess the patient suffering from diabetes and plan the modified diet accordingly	1,2, 3,4

T1: Srilakshmi B., Dietetics, New Age International (P) limited Publications, 2004.

T2: Singh J., Handbook of Nutrition and Dietetics, Lotus Press, 2012

### **REFERENCE BOOKS:**

R1: Joshi, S. A., Nutriton and Dietetics, Tata McGraw Hill Publications, New Delhi, 2004.

R2: Srilakshmi B., Dietetics, New Age International (P) limited Publications, 2004.

## **OTHER LEARNING RESOURCES:**

https://www.researchgate.net/publication/332318698 Counselling Skills for a Dietitian

	CO PO Mapping							
SN	SN Course Outcome (CO)							
1	Learn and discuss the different aspect of dietician in healthcare sector. Acquire the knowledge of the relationship of dietician with health and develop skills required in Nutritional counseling	1,8						
2	Learn and apply adaptation of therapeutic diets in different disease state	1,2,5,8						
3	Acquired knowledge on nutritional management in infections and fever	1,2,5,8						
4	Apply the importance of therapeutic diet in cardiovascular disease, diabetes and gout.	1,2,5,8						
5	Evaluate the significance in the modifications of diet in gastrointestinal diseases. Understand different Malabsorption Syndrome	1,2,5,8						

			SEMESTI								
Course T	itle		NUTRITION T				CLE				
Course co	ode	24BSFD223R	Total credits: 2	L	T	P	S	R	O/F	C	
		NT01	Total hours: 307	Γ 2	0	0	0	0	0	2	
Pre-requi		Nil	Co-requisite	E IN			Nil	.•			
Program			achelor of Science i								
Semeste	er	Spring/ IV semester of second year of the programme									
Course		1. To understand the physiological stages of different age groups.									
Objectiv	ves	2. To understand the nutritional requirements in different age groups.  3. To plan menu based on the requirements of various age groups.									
CO1		_				ge gro	ups.				
CO2		Learn the concept of balanced diet and meal planning Discuss the physiology and dietary requirements during pregnancy and lactation.									
CO ₂			nal requirements du								
CO4			logical changes in the		-		-				
			changes during vari								
CO5		lifecycle.	changes during vari	ous stages	or gre	, vv tili ti	ina ac v	Стории	one emoug	Smout	
Unit-				Contact				_			
No.		Conte	nt	Hour	Learning Outcome				KL		
	Bal	lance diet and meal	planning:								
	Det	finition, importance	of balance diet for								
	diff	ferent age groups, im		To know about the balance diet							
I	to b	e followed while pla	8			about ti quireme		nce diet	1,2		
	die	t, Food Pyramid, Prii	nciples and steps		and	ns rec	₁ um eme	iii.			
	inv	olved in meal planning	ng, factors								
	infl	luence meal planning	g, food groups.								
		trition in pregnanc									
		gnancy- Physiologic		To learn the changes and nutritional requirement during pregnancy and lactation							
	_	gnancy, nutrition rec									
II		mplications of pregn	10								
		ctation- Physiology o									
		mones, nutritional re									
		al planning for pregr									
		men trition during infan	cv. Infancy-								
		owth and developmen	•								
		uirements, breast fee	*								
	_	ant formula. Introduc	-								
		plementary foods, w									
	_	al planning for infan	•								
		tritional needs duri			To 1	earn t	he nutr	itional			
III		ly childhood (Toddle	_	14	requ	ireme	nt duri	ng infa	ncy and	1,2	
	Pre	schoolers) - growth	spurt, nutrient		chile	dhood	[				
	nee	eds, nutritional relate	d problems,								
	fee	feeding Pattern and problems School children- Nutritional									
	req	requirements, Importance of snacks,									
	sch	ool lunch. Meal plan	ning for children								
					T. 1		1 1		1		
IV	N	trition adalescence:	Physiological and	12			he phys		nd	1,2	
	1 <b>7 U</b>	trition adolescence:	r nysiological and		norr	nonal	change	s and			

	psychological changes, body image,		nutritional requirement	
	growth, nutrient need, food choice, eating			
	habits, factors influencing needs and			
	eating disorders. Meal planning for			
	adolescents			
	Nutritional needs during adulthood:			
	Importance of balance diet, nutritional			
	demands according to the level of activity			
	patterns. Meal			
	planning for adults			
	Nutritional needs during old age:			
	Process of ageing, common health			
v	problems during old age, and dietary	10	To learn the nutritional	1.2
V	modifications specially reference to		requirement during old age	1,2
	consistency of the food. Meal planning			
	for old age peoples.			

T1: Robinson C. H., Lawer M. R., Chenowelth. WIC., and Garwich A. E., Normal and Therapeutic Nutrition, McMillan Publishers Co., Newyork, 17th Edition 1990.

## **REFERENCE BOOKS:**

R1: Srilakshmi. B., Dietetics, 7th edition, Willey Eastern Ltd., New Delhi, 2014.

## **OTHER LEARNING RESOURCES:**

https://pmc.ncbi.nlm.nih.gov/articles/PMC5104202/https://pmc.ncbi.nlm.nih.gov/articles/PMC7926714/

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Learn the concept of balanced diet and meal planning	1						
2	Discuss the physiology and dietary requirements during pregnancy and lactation.	1						
3	Discuss the nutritional requirements during infancy and school-going children	1						
4	Describe the physiological changes in the nutritional needs of adolescents and adults	1						
5	Gain knowledge on changes during various stages of growth and development throughout lifecycle.	1,8						

	SEMESTER – IV Course Title TECHNO PROFESSIONAL COURSE II (BAKERY SCIENCE)										
Course T	itle	TECH	NO PROFESSIONA	L COU	RSE II T	BAK P	ERY S	SCIEN R	·		
Course c	ode	24BSFD225R	Total credits: 1	0	0	0	4	0 0	O/F 0	C 1	
Pre-requi	isite	Nil	Co-requisite			Nil					
Program			Bachelor of Science	in Food,	Nutri	tion ar	ıd Die	tetics			
Semest	er	S	pring/ IV semester	of second	l year	of the	progr	amme			
Cours	P	1. To provide knowledge on science behind baking.									
Objectiv		-	vledge on basic funct			-		ed in di	fferent p	roducts	
			damental mixing me								
CO1			Demonstrate proficient use of measuring and weighing techniques.  Master fundamental mixing methods and their applications.								
CO2			Successfully bake a variety of basic baked goods with consistent quality								
CO4			eshoot common baki				one qu				
		*	of baking principles			ty of b	aked g	oods w	ith varyi	ng levels	
CO5		of complexity.									
Unit-		Conte	nt	Contact		Lear	ning (	Outcon	1e	KL	
No.	Dag	ia Dalvina Taahnia		Hour	-						
		ic Baking Techniq ighing and Measurir									
		urate weighing and	-								
		redients using variou									
		suring cups, spoons									
		king Methods:									
		nonstrate and practic	-		Dev	Develop fundamental baking skills like accurate					
		hod, rubbing-in met hod.	hod, whisking		skil						
I		nod. pare simple batters a	3		measurements, Mixing						
	_	erent mixing technic			methods, Baking techniques, identify and troubleshoot common baking problems						
	Bak	ing Techniques:		1							
		rn to use different ty		Con							
	,	nventional, convecti									
		ctice baking cookies ple breads.									
		-	fy and troubleshoot								
		nmon baking probler	•								
	ove	rbaking, underbakin	g, uneven rise).								
		ad Making									
		st Handling: Learn	-								
		understand its role and Dough Preparation	_								
		ad Dough Freparand ad dough using strai	-								
		nge and dough meth	-								
II	_	ping Techniques: Pi		3		_		echniqu	ies of	1,2,3,4	
	brea	ad dough into variou	is forms (loaves,		mak	ing bro	ead				
		s, buns).									
		ofing: Understand th	_								
	_	ofing and control pro ing Bread: Bake dif	~								
		ad (white bread, who	* *								
	5100	( Willie Oreau, Will	ore milear orear,								

	rolls).			
III	Cookies and Biscuits Cookie Dough Preparation: Prepare cookie dough using various methods (creaming, mixing). Cookie Shaping: Practice different cookie shaping techniques (dropping, rolling, cutting). Baking Cookies: Bake various types of cookies (sugar cookies, chocolate chip cookies, oatmeal cookies).	5	To emphasize both the technical skills involved in cookie production (mixing, shaping, baking) and the understanding of the underlying principles that contribute to successful cookie making.	1,2,3,4
IV	Cake Making Cake Batters: Prepare different types of cake batters (sponge cake, butter cake, chiffon cake).	5	Learn to successfully prepare batters for sponge cake, butter cake, and chiffon cake, demonstrating an understanding of the unique ingredients and mixing methods for each type.	1,2,3,4
V	Icing and Decoration: Prepare basic icings (buttercream, fondant) and frost cakes. Practice simple cake decorating techniques (piping, frosting).	5	Learn to prepare basic buttercream and fondant icings, frost cakes evenly and neatly, and demonstrate basic cake decorating techniques such as piping and frosting.	1,2,3,4

T1: Food Processing Technology: Principles and Practices" by R.P. Singh and D.K. Salunkhe

## **REFERENCE BOOKS:**

R1: The Joy of Baking" by Shirley Corriber

### **OTHER LEARNING RESOURCES:**

 $\underline{https://students.aiu.edu/submissions/profiles/resources/onlineBook/h5d3M4_Science_of_Bakery_Products_\underline{pdf}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Demonstrate proficient use of measuring and weighing techniques.	1,8					
2	Master fundamental mixing methods and their applications.	1,8					
3	Successfully bake a variety of basic baked goods with consistent quality	1,8					
4	Identify and troubleshoot common baking problems	1,8					
5	Apply knowledge of baking principles to create a variety of baked goods with varying levels of complexity.	1,8					

			SEMESTER									
Course T	itle		FOOD TE		O	GY II					_	
Course co	ode	24BSFD224R	Total credits: 4		L	T	P	S	R	O/F		
			Total hours: 45T+	-30P	3	0	2	0	0	0	4	
Pre-requi		Nil	Co-requisite					N				
Program												
Semeste	er		oring/ IV semester of s				_	_	me			
Course			processing of dairy, ext		d ii	rradiate	d foo	od.				
Objectiv	293	-	preservation of various									
			ifferent packaging tech					ustry	•			
CO1			od processing and prese									
CO2		Learn about dairy technology. Discuss different processing techniques of milk and milk										
		products										
CO3		_	trusion technology in fo	_		_	_					
CO4			assification of food irra	diation a	nd	ıt's pro	babl	e use	s in fo	od		
		processing		1.0	- 1	11.			. 1		•	
CO5			materials, food additiv	es and fo	od	quality	eval	luatic	n tech	ınıque	s in	
		product developm	ent	<u> </u>	4							
Unit-No.		Con	tent	Contac	et	Lea	arnir	ıg Oı	ıtcom	e	KL	
	T 4		food was seeding	Hour								
		preservation tech	us food processing									
		ezing-Introduction										
		-										
		eezing, definition, principle of freezing, nanges occurring during freezing, types of										
		zing, thawing, char			Learni	ina al	out :	variou	c			
I		its effect on food.	10		food p	_			.5	1.2		
1		ing and Dehydration	10		preser		_		ries	1,2		
		means of preserva			preser	valio	n tee	morog	5103			
		veen sun drying an										
			eat and mass transfer,									
		ors affect ingrate o										
		rs used in the food									in	
		ry technology- Ir	<u>*</u>									
		eurization, homoge										
	_	-	tion, recombination,			Learni	ing al	out (	dairy			
	_	onstitution, differen				techno	_		-		1.2	
II		erent milk products		8		advan	ced p	roces	sing		1,2	
	Daiı	rying, National Dai	iry Development			techni	que					
	Boa	rd, Operation Floo	d, Development in									
	milk	c processing										
	Ext	ruded foods- intro	duction, classification			I	ina -1	20114	Darter:	dad		
TIT	of e	xtruders, merits &	demerits of extrusion	7		Learni	-				1.2	
III	tech	mology, effect of E	xtruded foods on	/		produc		ınsı	noces	sing	1,2	
	nutr	ritive value of food	S.			techniques						
	Foo	d Irradiation-Intr	oduction, kinds of									
	ioni	zing radiations use	d in food irradiation,			Learni	ing al	oout	variou	S		
IV		s of radiation proce	-	10		aspect		dvano	ed fo	od	1,2	
		istry, concept of co				proces	sing					
	func	ctions, effects of fo	od irradiation, safety									

	of irradiated foods  Thermal Processing-Concept of pasteurization, sterilization, commercial sterilization and blanching.			
V	Packaging technology-introduction, basic packaging materials, effects on nutritive value of foods  Food Additives- introduction, classification, uses, merits & demerits, Fortification & Enrichment-definition & importance of fortified and enriched foods  Evaluation of Food Quality	9	Learning about packing technology and food additives	1,2
VI Practical	Setting up of sensory evaluation lab and introducing the concept of organoleptic testing.  Drying of food products  To give the concept of shelf life of different foods (processed and unprocessed)  Identification of different types of packaging materials used in the food industry  Visit to different food processing industries	30	Learning about sensory evaluation Learning about drying process Learning about shelf life of processed and unprocessed product Learning about different packaging materials Learning about techniques of food industries	1,2,3,4

T1: Food Science, Fifth Edition, Norman N. Potter, Joseph H. Hotchkiss

## **REFERENCE BOOKS:**

R1: Rahman, M. S., Handbook of Food Preservation. MARCELDEKKER Inc. 1999

## OTHER LEARNING RESOURCES:

https://www.youtube.com/watch?v=kfExSuaCq5Q

https://www.youtube.com/watch?v=yVPWcnBiFeQ

https://tn.gov/education/article/cte-cluster-agriculture-food-naturalresources.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Discuss various food processing and preservation techniques	1					
2	Learn about dairy technology. Discuss different processing techniques of milk and milk products	1,8					
3	Gain insight on extrusion technology in food product processing	1,8					
4	Learn about the classification of food irradiation and it's probable uses in food processing	1,8					
5	Discuss packaging materials, food additives and food quality evaluation techniques in product development	1,8					

			SEMESTE										
Course	Title		ENGLISH FO						_				
Course	code	24UBPD222R	Total credits: 2		T	P	S	R	O/F	C			
Pre-req	misits	Nil	Total hours: 60	P 0	0	4	0 Nil	0	0	2			
Progra			Co-requisite achelor of Science i	n Food N	Jutritio	n and I		ice					
Seme			ring/ IV semester o										
Seme	3111	_	_			_	_		dino				
		1. To develop public speaking skills, including script preparation, understanding nonverbal cues, overcoming fear, and practicing speaking strategies.											
Cou	rse	2. To provide practical experience in preparing, submitting, and screening resumes and											
Objec	tives	cover letters.											
		3. To teach email etiquette, including the structure of emails and effective drafting											
		techniques.											
CO	)1	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and											
		practice public speaking strategies.											
CO		_ ^ ^	h skills to prepare, s										
CO	3		different parts of an					_	_	es.			
CO	4		Prepare students for interviews by practicing commonly asked questions and										
		participating in mock interview sessions.  Students will understand the concept of conflict management, identify different types,											
CO	5	and analyze its effe	•	Commet	manage	illelli, ic	ientii.	y diffe	леш тур	es,			
Unit-				Contac	+								
No.		Conten	t	Hour		Learni	ing O	utcom	ıe	KL			
	Publi	c Speaking Skills		Stud	lents wil	l be a	ble to	create					
	1 -	paration of Scripts a	_		effe	effective speaking scripts,							
I	1	erbal cues of Public	7	interpret nonverbal cues,					3, 4				
	1	derstanding and Ove	ercoming Fear of	,	1	age pub	_	_		], '			
	1	c Speaking			ety, and	_		fective					
		ectice strategies of P			spea	king tec	hnıqu	es.					
	letter	ical session on Res	ume and Cover										
		paration, submission	& screening of		Stud	lents wil	l pren	are, si	ubmit.				
II	Resur	•	a w serecining or	5		evaluate				3			
		ctical session on co	ver letter screening		cove	cover letters.							
	sessio												
	F '	Tr' "			C.		1 1		1.41				
***	1	Etiquettes	and TTarre	_		lents wil				2.2			
III	1	ferent Parts of Email fting emails effectiv		5		cture of o		s and o	ıraII	2, 3			
		riew Skills (Mock se				lents wil		ver co	mmon				
		paring Commonly as				view qu			111111011				
IV	Quest			7		idently			n well	3, 5			
	`	ock Interview session	ns		II	ock inte	_						
	Com	liot Managamant			Stud	lents wil	l und	erstan	d the				
		lict Management inition				cept of c							
V		mition pe of Conflict Mana	gement	8		agemen		-		2, 4			
		fects of Conflict Ma	~			erent typ	es, an	d anal	lyze its				
					effe	ets.							

- T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2: Reed, James. 2016. 101 Job Interview Questions You'll Never Fear Again, Plume.
- T3: Pease, Barbara. 2006. The Definitive Book of Body Language, RHUS.
- T4: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

### **REFERENCE BOOKS:**

- R1: Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction Harper Perennial
- R2: Taylor J. and Wright, J., IELTS Advantage Reading Skills: A step-by-step guide to a high IELTS reading score, Delta Publishing by Klett.
- R3: Kelley, Thea. 2021. Get That Job: The Quick and Complete Guide to a Winning Interview, Plovercrest Press.
- R4: Murphy, Raymond (2012) English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press

#### OTHER LEARNING RESOURCES:

https://learning.shine.com/talenteconomy/career-help/top-group-discussionskills https://www.coursera.org/articles/conflict-management

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and practice public speaking strategies.	3,4,7,8					
2	Equip students with skills to prepare, submit, and screen resumes and cover letters.	3,4,7,8					
3	Teach students the different parts of an email and effective email drafting techniques.	3,4,7,8					
4	Prepare students for interviews by practicing commonly asked questions and participating in mock interview sessions.	3,4,7,8					
5	Students will understand the concept of conflict management, identify different types, and analyze its effects.	3,4,7,8					

			SEM	IESTER –	IV								
Course	e Title		BASIC AC	CCLIMAT	IZIN	G SKI	LLS (I	BAS)					
Course	e code	24UULS201R		redits: 1	L	T	P	S	R	O/F	С		
				urs: 30P	0	0	2	0	0	0	1		
Pre-re		Nil		quisite	1 37			Nil					
Progra				ester of second year of the programme									
Semo	ester									1:			
Cou	rse	. To impart knowledge of the fundamentals of Hospitality industry and its applications. Students will be able to familiarize with the cooking equipments & Utensils.											
Objec	etives	3. Students will be ab				•			Jiensii	S.			
CO	<b>\1</b>						valions	5.					
					cooking methods.								
	CO2 Students will gain the knowledge of CO3 Students will be able to gain the tra				-			ooms.					
	)3							d'e am	anitia	for day	, to		
CO	)4	day use.	Students will be able to acquire the knowledge of basic household's amenities for day-to-										
		Basic use of Travel &	Tourism M:	anagement	which	will r	renare	studen	ts for 1	ifelong			
CO	)5	learning	o i ourisiii ivi	anagement	WIIICI		пераге	Studen	.03 101 1	nerong			
Unit-				Contact									
No.		Content		Hour			Learni	ng Ou	tcome		KL		
	Introd	luction to Accommod	ation		Stud	lents w	ill be a	ble to	effecti	vely			
Mana			ution		hand	ile tele	phone	calls, c	organiz	ffectively ganize appropriate			
		• Telephone handling technique			roon	ns effi	ciently, utilize appropriate						
I		Organizing of Rooms.			cleaning agents and equipment,					3, 4			
	_	ning agents.		perform professional bed-making,					ng,				
		ning equipment's and				mainta	in a hi	gh stan	dard o	f			
	• Bed	making Process.			clear	nliness	and gu	iest sei	vice				
		amentals of Cooking			Stud	lents w	ill dem	onstra	te an				
		nition of cookery –Ain	n &	understanding of cooker						-			
II	_	ectives of cooking.		7		-	ygienic	•			3		
		of basic cooking equip		,			se of co	_					
		onal Hygiene and Safe	ty				o achie	ve desi	ired cu	linary	3		
	• Use	of Fire & Fuels			resu								
	N# 41	J								wledge			
		ods of Cooking					cookin	_					
		erent Cuts.		_			differen						
III		of Herbs and Spices.		7			s and s	_			2, 3		
		c Food and Beverage I	reparation.		1		ge prep			-			
• Regi		onal food Habits.				an unc l habits	lerstand	iing oi	region	iai			
	Forms	& Format's			1000	i Haull	•						
	• C –fe												
		ervation form			Und	erstan	d and u	tilize C	C-form	for			
IV		stration form		8			ale of g	goods t	o clain	n input	3, 5		
	_	port Application form			tax c	eredit.							
		ll Rent Agreement											
	Lega	n Kent Agreement											

T1: Arora K (2011). Theory of cookery, Frank brothers & company (pub) pvt ltd-New Delhi.

T2: Bruce H. Axler, Carol A. Litrides (2010) Food and Beverage Service Volume 1 of Wiley Professional Restauranteur, Guides.

T3: Mohammed Zulfikar (2010) - Introductions to Tourism and Hotel Industry Introduction to Tourism and Hotel Industry. Vikas Publishing.

T4: Sudhir Andrews (2013) Food and Beverage Service: A Training Manual, Tata McGraw Hill, 2013.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Students will have basic knowledge of cooking methods.	1,8					
2	Students will gain the knowledge of organizing & Cleaning of Rooms.	1,8					
3	Students will be able to gain the travel management concept.	1,8					
4	Students will be able to acquire the knowledge of basic household's amenities for day-to-day use.	1,8					
5	Basic use of Travel & Tourism Management which will prepare students for lifelong learning.	1,8					

			SEMEST	TER – IV							
Course	Title		DIGI	TAL LITI	ERACY	I					
Course	code	24UUDL101R	Total credits: 1 Total hours: 30l		T 0	P 2	S 0	R 0	O/F 0	C 1	
Pre-rec	quisite	Nil	Co-requisite	Nil	'			•			
Progra	amme	В	achelor of Science	in Food, N	Nutritio	n and	Dieteti	ics			
Seme	ester	S	pring/ IV semester	r of second	l year o	of the p	rogra	mme			
Course Objectives		<ol> <li>Students will be uses.</li> <li>Students will be</li> <li>Students will be for digital finance</li> </ol>	able to use MS-Off able to use the Inter	ice suite fo	or vario	us purp	oses.				
CO1 Students will have basic understanding of Computer Hardware, Software and Comhandling.							Compu	ter			
CC	)2	Students will be able to solve basic information management issues using MS-Office Products.									
CC	)3	Students will be abl	le to efficiently sear	arch the Internet for required information.							
CC	)4	Students will be able to use computing technically ethically, safely, securely and legally for day-to-day use.									
CC	)5	Understand the function of the creating accounts at the land and the land and the land and the land are the land at the land are the land at the land are the lan	nd utilizing digital p		-	_	•			ards,	
Unit- No.		Conten	t	Contact Hour		Learn	ing O	utcome		KI	
I	i. Com function ii. Dif	amentals of Computations.  Grant Types of Computations.	ter and their	7	compo	onents of unction e types upplicate	of a cons, and of con	undamen mputer s explore mputers a cross var	system, the and	3,4	
		luction to MS-Office		in Mi	crosoft	Office	al knowl Suite, cy in cre				

No.	Content	Hour	Learning Outcome	KL
I	Fundamentals of Computer Systems i. Components of a Computer and their functions. ii. Different Types of Computers and their Applications.	7	To understand the fundamental components of a computer system, their functions, and explore the diverse types of computers and their applications across various domains.	3, 4
п	Introduction to MS-Office i. Components of the MS-Office suite. ii. Creating documents with MS-Word. iii. Creating Presentations with MS-PowerPoint. iv. Creating Spreadsheets with MS-Excel.	5	To gain foundational knowledge in Microsoft Office Suite, including proficiency in creating and manipulating documents with Word, presentations with PowerPoint, and spreadsheets with Excel.	3
Ш	Introduction to Internet & Cyber World i. Introduction to Computer Networks and Internet. ii. World Wide Web, Websites and Web portals, Web browsing. iii. Web Searching, Search engines, Introduction to Google Search Engine; How to search using Keywords, topics of Interest, etc. iv. Creation and use of Email Accounts. v. Cyber Crimes.	5	To understand fundamental concepts of computer networks and the internet, including web browsing, searching, email usage, and basic cybersecurity awareness, particularly focusing on cybercrimes.	2, 3
IV	Introduction to Social Media i. The Power of social media, Relevance of	7	To understand the power and relevance of social media in the	3, 5

	social media in present scenario.		current scenario, learn to create	
	ii. Creating accounts and using some popular		and utilize popular social media	
	social media portals and Apps like WhatsApp,		platforms, and develop a strong	
	Facebook, Twitter, Instagram, LinkedIn.		understanding of appropriate	
	iii. Social Media Etiquettes.		social media etiquette.	
			To understand the fundamentals of	
	Digital Payments		digital payment systems and gain	
	i. Introduction to Digital Payment Systems.		practical experience in creating	
V	ii. Creating accounts and using Digital	6	accounts and utilizing various	2, 3
	Payment Systems like Credit Cards, Debit		digital payment methods such as	
	Cards, Net banking, UPI.		credit cards, debit cards, net	
			banking, and UPI	

T1: Sinha Pradeep K. and Priti Sinha. *Computer Fundamentals: Concepts Systems & Applications*. 3rd ed. New Delhi: BPB Publications.

T2: Goel, A, 2010. Computer Fundamentals, Pearson India.

### **REFERENCE BOOKS:**

R1: Balaguruswamy, E. 2009 Fundamentals of Computers, Tata McGraw-Hill Education.

R2: Balaguruswamy, 2014. E. Fund Of Comp & Programming (Updated Ed Sem. I, Au) Tata McGraw-Hill Education.

R3: Lawson, C. 2022. Introduction to Social Media, Oklahoma State University.

### OTHER LEARNING RESOURCES:

https://www.w3schools.com

https://edu.gcfglobal.org

https://www.tutorialspoint.com

https://www.javatpoint.com/

Latest updates available in WWW.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students will have basic understanding of Computer Hardware, Software and Computer handling.	7,8				
2	Students will be able to solve basic information management issues using MS-Office Products.	7,8				
3	Students will be able to efficiently search the Internet for required information.	7,8				
4	Students will be able to use computing technically ethically, safely, securely and legally for day-to-day use.	7,8				
5	Understand the fundamentals of digital payment systems and gain practical skills in creating accounts and utilizing digital payment platforms such as credit cards, debit cards, net banking, and UPI.	7,8				

			SEMESTER	R – IV	7							
Course T	itle	EXTRA-CURRICULAR ACTIVITIES										
Course code		24UBEC221R	Total credits: 0.5	L	]	Γ	P	S	R	O/F		C
				0	(	)	0	2	0	0		0.5
Pre-requi		Nil	Co-requisite					Nil				
Program			achelor of Science in									
Semeste	er		ring/ IV semester of									
Course Objectives		<ol> <li>To ascertain physical and mental development of the students and select best performers for state, national and international level competition.</li> <li>To enhance and improve student's talents in the field of sports, yoga, music, dance, drama, etc through AdtU club activities and workshops.</li> <li>To improve their ability to solve problems creatively and effectively.</li> </ol>										
CO1		_	p Skills-Students will			-			-	ugh vari	ous	3
CO2		Improve Social Interaction-Students will learn to interact and build relationships with others.										
CO3		Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.										
CO4		Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.										
CO5		Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.										
Unit- No.		Con	ntent		Conta Hou		Le	arnir	ıg Ou	tcome		KL
I	par cur Un Sw Ter gar Dra enc act into	mes; Dance; Music; Yama; Literary activitic couraged to participal ivities, workshops, corest and hobbies; Repressionals/personals	ports, music, and co- ning the clubs of the utsal; Cricket; Badminton; Table her outdoor and indoo Vocals; Photography; ies); The students are te in regular club competitions as per the enowned skilled	eir	Students will develop and refine their interests and talents through active participation in diverse sports, music, and co-curricular clubs, benefiting from expert guidance and engaging in workshops and competitions.					1,2		

# **REFERENCE BOOKS:**

R1: "Extracurricular Activities: Essential Guides for Students" by John G. Gabriel

R2: "Developing Personal, Social and Emotional Skills through Extra-Curricular Activities" by Sally Bailey

## OTHER LEARNING RESOURCES:

 $\underline{https://www.prospects.ac.uk/applying-for-university/university-life/the-importance-of-extra-curricular-activities}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Enhance Leadership Skills-Students will develop leadership abilities through various activities.	3,4,7,8					
2	Improve Social Interaction-Students will learn to interact and build relationships with others.	3,4,7,8					
3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.	3,4,7,8					
4	Strengthen Problem-Solving Skills- Students will improve their ability to solve problems creatively and effectively.	3,4,7,8					
5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.	3,4,7,8					

		SEMESTER –	V									
Course Tit	Course Title CLINICAL NUTRITION I											
Course Coo	le 24BSFD311R(CN)	<b>Total Credits: 4</b>	L	T	P	S	R	O/F	C			
Course Co	ie 24bSFb311K(CN)	Total Hours: 45T+30	0P 3	0	2	0	0	0	4			
Pre-requisi		Co-Requisite				Ni						
Programmes Bachelor of Science in Food, Nutrition & Dietetics												
Semester		all/ V semester of thir										
Course	-	erent aspect of diet mo			_							
Objectives	2. To study about the different nutrient modification at different disease state.											
	3. To understand the s	ymptoms of different of										
CO1		ent aspect of food nutri										
CO2		rent aspect of diet mod			daptat	ions in	disea	ises sta	ite			
CO3		on planning of differen										
CO4		of therapeutic diet in o				C 1:		1 1				
CO5	Evaluate the signification	nce in the modification		in dif	terent	feedin	g met	hods.	ı			
Unit-No.	Conte	nt (	Contact Hour	I	Learn	ing Ou	itcom	e	KL			
	Ethiog and responsibilities	a of Dictioion	Hour									
I	Ethics and responsibilities Indian Dietetic Associati		5	Role	of die	tician			1,2			
	Principles of therapeutic	-					-					
II	planning for specific dise		10		-	hospit			1,2			
	counseling in hospital se		10	differe	ent, od	le of fe	eding		1,2			
	Energy, Basal Energy Ex	-										
	and the nutritional requir	• ' '										
TTT	reference woman and ma		10	Concisely covers the key				-	1,2			
III	influencing energy exper	nditure, estimation	10	aspects of energy, BEE, and nutritional requirements.								
	methods, and the role of	macronutrients and										
	micronutrients in maintain	ining health.										
				To understand the principle				iples				
	Determination of nutrition	onal assessment in				al asses			1,2			
	clinical settings. Routine					ngs, ir		_				
	Preoperative and postope	-				eview o						
IV	and review of hospital di	et. Basic concepts	10	_		ts (pred	_					
	and methods of - (a) Ora	l feeding (b) Tube			•	rative)		ts and				
	feeding (c) Parental nutri	tion (d) Intravenous		_		oral, tu	_					
	feeding.					orai, it itraver		Iu				
				feedir		itiavei	1043					
						he kno	wled	ge and				
	Nutritional management	in specific disease	40			ly prir	•	_				
V	conditions.		10				_		1,2			
				nutrition in the management of specific disease conditions.								
	• Planning, preparations	and calculations of		To de	velop	the ab	ility to	plan,				
	nutritive value of: Rout	ine hospital diet:		prepa	re, and	l calcu	late th	ne				
	Liquid diet: Clear liqui			nutriti	ive val	ue of	variou	IS				
VI	Semisolid diet, Soft die	t	30	_		ts (rou		_	1 2 2 4			
Practical	• Planning, preparations		30			teral fe	,		1,2,3,4			
	nutritive value of: Feed					nus fo						
	feeds and Jejunostomy	, ,	conditions, and effective					-				
	• Menu planning for febr	rile conditions		couns	el pati	ents o	n dieta	ary				

Role-play diet counseling sessions with	modifications through role-
peers or standardized patients, focusing on	playing and case study
communication, motivational interviewing,	analysis, emphasizing
and behavior change techniques.	communication, motivational
• Analyze case studies of patients with	interviewing, and behavior
specific diseases (e.g., diabetes, cancer,	change techniques.
HIV/AIDS) and develop individualized	
nutrition plans.	

T1: Joshi, S. A., Nutrition and Dietetics, Tata McGraw Hill Publications, New Delhi, 2004.

T2: Srilakshmi B., Dietetics, New Age International (P) limited Publications, 2004

### REFERENCE BOOKS

R1: Raymond, J. L., & Morrow, K. (2020). Krause and mahan's food and the nutrition care. Elsevier Health Science

R2: AntıaF.P., & P. Abraham. (2002). Clinical Dietetics and Nutrition.

R3: Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins

R4: Escott-Stump,S. (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkins.

R5: Garrow, J. S., James, W.P.T.

### **OTHER LEARNING RESOURCES:**

https://www.cdss.ca.gov/agedblinddisabled/res/VPTC2/9%20Food%20Nutrition%20and%20Preparation/Types of Therapeutic Diets.pdf

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Understand the different aspect of food nutrients and its affect in health and wellbeing	1, 8				
2	Learn and apply different aspect of diet modification and adaptations in diseases state	1,2,5,8				
3	Acquired knowledge on planning of different hospital diet	1,2,5,8				
4	Apply the importance of therapeutic diet in diseases condition	1,2,5,8				
5	Evaluate the significance in the modifications of diet in different feeding methods.	1,2,5,8				

SEMESTER – V											
Course Tit	Course Title CLINICAL NUTRITION II										
Course Cod	le 24BSFD312R(CN)	Total Credits: 4	L	T	P	S	R	O/F	C		
	` ′	Total Hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requisi		Co-Requisite				Ni					
Programme		achelor of Science in Foo									
Semester		fall/ V semester of third y	•								
		ne different biochemical m							C .1		
Course		2.To understand how this metabolism takes place in correlation with the nutrients of the									
Objectives		0.1100	~ ·	1.							
		symptoms of different det									
CO1		iate between obesity, over	_		l under	weigl	nt,				
	~	ifications and associated h				201 1					
		cal role of nutrition in mai		_			•		nting		
CO2		ses (CVDs) such as athero	oscleros	sis, h	yperlip	oidem	ia, and	l			
	hypertension.		0.11.1		111	•					
		orehensive understanding of				-	_		dence,		
CO3	1	, symptoms, metabolic dis			_			-	1		
	l .	management, pharmacotherapy (including insulin types and hypoglycemic agents), and									
		potential long-term complications.									
CO4	_	Demonstrate a comprehensive understanding of the role of nutrition in the management of									
		renal diseases  Understand the various courses of liver diseases, including viral infections (honetitis)									
CO5	Understand the various causes of liver diseases, including viral infections (hepatitis), alcohol abuse, non-alcoholic fatty liver disease (NAFLD), autoimmune disorders, and										
COS	genetic condition.										
			Contac	Contact				T			
Unit-No.	Con		Hour		Lear	ning	Outco	ome	KL		
	Obesity and underweig	· · · · · · · · · · · · · · · · · · ·									
I	complication and healt	· •	5		Role of	f diet	ician		1,2		
	treatment and other rec										
		of nutrition in cardiac efficiency,									
	incidence of Atheroscl	•									
	principles, Hyperlipide	• •	Learn			ning of hospital diet,					
II	causes and dietary trea		10		differen	_	_		1,2		
	restricted diet, level of	· ·				,		8			
	sources of sodium, dan	iger of severe sodium									
	restriction.	\T '1 1		-							
	Diet in Diabetes mellit	,									
	predisposing factors. b	, , ,		(	Concis	ely co	vers tl	ne key			
111	and tests for detection.	· ·	10	a	aspects	of en	ergy, l	BEE,	1.0		
III	diabetes d) Dietary trea		10	a	and nut	rition	al		1,2		
	management e) Hypog			1	require	ments	S.				
	insulin and its types. f) diabetes	Complication of	ot								
	Diet in Renal diseases:	Racic renal function		Т	To unde	retor	d tha		+		
	symptoms and dietary				rincipl			onal			
	and chronic glomerulo				ıssessm						
IV	renal failure, dialysis.	_	10		ettings				1,2		
	& treatment, acid and a	-				_		_			
	neutral foods and dieta		study and review								
	mountai 10003 and uicla	1) a camiont.	routine hospital diets					<u> </u>			

			(preoperative and postoperative), and to explore the basic concepts and methods of oral, tube, and parenteral/intravenous feeding.	
V	Diet in diseases of the liver, gall bladder and pancreas, a) Etiology, symptoms and dietary treatment in - Jaundice, hepatitis, cirrhosis and hepatic coma. b) Role of alcohol in liver diseases. c) Dietary treatment in cholecystitis, cholelithiasis and pancreatitis. Patient education and counseling-Assessment of patient needs, establishing rapport, counseling relationship, resources and aids to counseling.	10	To acquire the knowledge and skills to apply principles of nutrition in the management of specific disease conditions.	1,2
VI Practical	<ul> <li>Planning and preparation of DASH Diet</li> <li>Planning, preparation and calculation of diet in cardio vascular diseases.</li> <li>Planning, preparation and calculation of diet in kidney failure, kidney transplant, renal complication and kidney stones.</li> <li>Planning, preparation and calculation of nutritive value.</li> <li>Planning, preparation and calculation of nutritive value of renal disorders: Renal calculi and Renal Transplantation</li> </ul>	30	To develop the ability to plan, prepare, and calculate nutritionally balanced diets, specifically focusing on the DASH Diet and adapting dietary plans for individuals with cardiovascular diseases, kidney failure, kidney transplants, renal complications, and kidney stones, while accurately determining the nutritive value of these diets.	1,2,3,

T1: Joshi, S. A., Nutrition and Dietetics, Tata McGraw Hill Publications, New Delhi, 2004.

T2: Srilakshmi B., Dietetics, New Age International (P) limited Publications, 2004

### REFERENCE BOOKS

R1: Raymond, J. L., & Morrow, K. (2020). Krause and mahan's food and the nutrition care. Elsevier Health Science

R2: AntıaF.P., & P. Abraham.(2002). Clinical Dietetics and Nutrition.

R3: Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins

R4: Escott-Stump,S. (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkins.

R5: Garrow, J. S., James, W.P.T.

# **OTHER LEARNING RESOURCES:**

 $\frac{https://www.cdss.ca.gov/agedblinddisabled/res/VPTC2/9\%20Food\%20Nutrition\%20and\%20Preparation/}{Types_of_Therapeutic_Diets.pdf}$ 

	CO PO Mapping					
SN	Mapped Program Outcome					
1	Define and differentiate between obesity, overweight, and underweight, including their classifications and associated health risks.	1,2,5,8				
2	Understand the critical role of nutrition in maintaining cardiac efficiency and preventing cardiovascular diseases (CVDs) such as atherosclerosis, hyperlipidemia, and hypertension.	1,2,5,8				
3	Demonstrate a comprehensive understanding of diabetes mellitus, including its incidence, predisposing factors, symptoms, metabolic disturbances, diagnostic tests, dietary management, pharmacotherapy (including insulin types and hypoglycemic agents), and potential long-term complications.	1,2,5,8				
4	Demonstrate a comprehensive understanding of the role of nutrition in the management of renal diseases	1,2,5,8				
5	Understand the various causes of liver diseases, including viral infections (hepatitis), alcohol abuse, non-alcoholic fatty liver disease (NAFLD), autoimmune disorders, and genetic condition.	1,2,5,8				

			SEMES	TER – V										
Course 7	Title			IED NU			I							
Course C	Code	24BSFD311R(AN)	Total Credit		L	T	P	S	R	O/F	C			
		, í	Total Hours: 45		3	0	2	0	0	0	4			
Pre-requ		Nil	Co-Requis						Nil					
Program			B.Sc. Foo											
Semest	er		Fall/ V semester						me					
Cours	e	1.To study about di	•			•		_						
Objecti		2. To study about th		-				_		-	nt.			
		3. To acquire know				•								
CO1		Reflect on the role									1			
CO2		Design a food prod	uct through the ap	plication	of kn	owled	ige o	t tooc	l ingre	dients and	1			
		Functional foods.												
CO3			Create and evaluate a product using the development process; Design and apply packaging Acquired knowledge on evaluating product quality and sensory properties											
CO4		•			-						nots			
CO5		Combine theoretical by ensuring.	n knowledge and j	practical S	KIIIS I	ю гер	1000	le exi	isung 1	toou prod	ucis			
		by chairing.		Contact										
Unit-No   Content				Hour		L	earni	ng O	utcom	ie	KL			
	Nev	v food product- Def	inition	Hour										
		sification, factors sh			Refl	ect or	ı the	role c	of food	l trends in	,			
I		duct development: so	8					elopm		1,2				
	-	th concern, impact of		Ü	Proc	_			oropii		1,-			
		uence and technolog	-											
		duct development-												
		dardization methods		Design a food product through the										
***	port	ion control; Calculat	tion of nutritive	0	1	-		_		of food	1.2			
II	valu	e and cost of produc	8	ingre	edien	ts and	1			1,2				
	and	storage stability eva		Fund	ctiona	ıl foo	ds							
	•	cedure.												
		duct evaluation- De	*		Crea	ite an	d eva	luate	a nroc	duct using	r			
		ecard and analysis o	f data. Selection											
III		training of judges.		10	the development process; Design and apply packaging						1,2			
		kaging-Suitability, o	levelopment of		For food products									
	•	kages and Labeling.	··			,	-							
	_	ality control – Object												
	_	ortance, functions of es of quality control												
	_	d quality assurance	•		Eval	110to 1	nrodi	ict au	ality a	nd				
IV		in quanty assurance opany quality assurar	~	9		ory p	•	•	anty a	iiu	1,2			
		robiological concern			SCIIS	ory p	горсі	tics						
		Ianaging quality in supply chain and												
		keting of food produ												
		ernment regulation												
	con	_	I											
		O/WHO codex Alin	nentarius		Con	bine	theo	etica	l know	ledge				
<b>T</b> 7	com	mission, PFA, AGM	IARK, BIS, FPO,	10						_	1.0			
V		average quality (FA		10	and practical skills to reproduce existing food products by ensuring						1,2			
		foodgrains, ISO9000	~ *			-	_	ındaro	-	9				
	HA	CCP-Background, p	orinciples,											
	bene	efits and limitation.												

	Consumer Protection Act (CPA)  Food adulteration – Common adulterants and tests to detect common adulterants.			
VI Practical	Introduction on developing various food products and selection of target group.  Market survey and Preparation of questionnaire.  Standardization of recipe, Preparation method, sensory evaluation.  Shelf life, packaging, labeling, costing, storage, transportation and distribution, advertising  Report writing and Presentation.	30	Learning about trends and innovation in food markets and developing a questionnaire Quality and sensory testing for food products; evaluate product quality and sensory properties Evaluation of food shelf life and development of food packaging for food products Combine theoretical knowledge and practical skills for established products and learning to present as a report Learn the analysis process of proximate composition	

T1: Rahman, M. S., Handbook of Food Preservation. MARCELDEKKER Inc. 1999

#### **REFERENCE BOOKS:**

R1: James G. Brennan, Food Processing Handbook, 2011

#### **OTHER LEARNING RESOURCES:**

https://www.fssai.gov.in/upload/uploadfiles/files/Manual_Meat_Fish_09_01_2017(1).pdf
https://www.pfndai.org/Document/Association_News/dairy_processing/Dairy_Products_Processing_Dr_Kanade.pdf

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Reflect on the role of food trends in the new product development process	1
2	Design a food product through the application of knowledge of food ingredients and Functional foods.	1
3	Create and evaluate a product using the development process; Design and apply packaging	1
4	Acquired knowledge on evaluating product quality and sensory properties	1,8
5	Combine theoretical knowledge and practical skills to reproduce existing food products by ensuring.	1,2

			SEMESTER – V									
Course T	itle		APPLIED NUTR	RITION	I							
Course Co	ode	24BSFD312R(AN)	Total Credits: 4		L	T	P	S	R	O/F	_	
Dua magui	ait a	Nil	Total Hours: 45T+ Co-Requisite	-30P	3	0	2	0 N	0	0	4	
Pre-requi Programs			Nil Co-Requisite Nil  B.Sc. Food, Nutrition & Dietetics									
Semeste			semester of third yea				mm	P				
		1. To study a different aspe	<u>*</u>			ogra						
Course Objectiv	29	2. To study the different re	gulatory bodies of foo	d safety	y an	_		tion	•			
		3. To understand the recen							1	1		
CO1			Understand the different applications of food science in food production and packaging.									
CO2		Learn about the regulatory		e and tec	chnc	ology	/.					
CO3		Understand the recent trend		i ₀ 1								
CO5		Acquire knowledge on difference of Evaluate the significance of		141.								
- 03		Lyandare the significance of	i recent food trends	Conta	) ot					1		
Unit-No.		Content		Hou		Le	arni	ng (	Outco	ome	KL	
I	mea	roduction: Concept of food asures-basic concept of HAC dling practices and ing.	• •	5	5				Learn different Constituents of foods			
II	pro	roduction to technologies ucessing: Hot and cold treatrand Primary Processing.		Learn technologies used in food processing					es	1,2		
III	heal	od additives-various types a lth. Food security-Concept, urity. Prevention of Food Ac.	factors affecting food	10	Learn different types of quality evaluation of food						1,2	
IV	Pro Bur	gulating authority- Fruit ducts Order (FPO), Meat Pre eau of Indian Standards (BI Agmark.	` ' '	10			rn d gulat		ent autho	ority	1,2	
V	Pac Mat	oduction to Food Packaging kaging Design. Different typ terials. Active and Intelligen kaging Regulations and Safa	pes of Packaging at Packaging. Food	10					ent ty cagin	_	1,2	
VI Practical	ar • P1 • P1 • P1 • P1 • P1 • D	atroduction to different equipment preservation reservation by heat treatment reservation by heat treatment reservation by cold treatment reservation of drying: ifferent methods of drying: reparation of extruded products	at: Sterilization, at: Blanching at: Refrigeration at: Freezer,deep  Mechanical drying Sun drying	30		equipro prestecht treattreattreatTec	atme thnicatme thnicatme	ent of ing a ation ues of the int, cont; ques nt ar ques	of and of hea old of da	ту	1,2,3,4	

T1: Rahman, M. S., Handbook of Food Preservation. MARCELDEKKER Inc. 1999

#### **REFERENCE BOOKS:**

R1: James G. Brennan, Food Processing Handbook, 2011

#### **OTHER LEARNING RESOURCES:**

https://www.fssai.gov.in/upload/uploadfiles/files/Manual_Meat_Fish_09_01_2017(1).pdf https://www.pfndai.org/Document/Association_News/dairy_processing/Dairy_Products_Processing_Dr_Kanade.pdf

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Learn about the processing technology and composition of cereals and millet.	1
2	Explain the processing technology and composition of pulses and legumes.	1
3	Acquire knowledge about the processing and quality attributes of fats and oils.	1
4	Learn about the classification and post-harvest changes in fruits and vegetables.	1,8
5	Analyze the post-mortem changes in meat and various preservation methods.	1,2

			SEMESTE	ER V									
	D* / I		TECHNO PROF		NAL	COUF	RSE I	II					
Course	Litle		(DIET COUNSELI	ING AN	D PA	TIEN	T CA	RE)					
Course	rode	24BSFD314R	Total credits: 1	L	T	P	S	R	<b>O</b> /3	F	C		
				0	0	0	4	0	0		1		
Pre-requ		Nil	Co-requisite					Vil					
Progran			Bachelor of Science										
Semest	ter		Fall/ V semester of				ograi	nme					
			various techniques u			_		.11:	1	. 4.			
Cours			ne use of various type		echniq	ues of	couns	elling i	n orde	r to			
Objecti	ves	_	s to achieve well-bein ne significance of die	_	madi	fication	a of t	haranaı	ıtio die	.+			
CO1			nciples and procedur										
		counselor.	norpies and procedur	cs of all	ci cou	113011118	s anu t	.110 1010	or uie				
CO2		Give them a clear picture of influence of lifestyle on health and wellbeing.											
		Analyze how acute and chronic illness affects the emotional, psychological well being											
CO3		and behavior of the individuals.											
CO4 Learn the techniques and skill of dietitian													
CO5			icance of dietitian in		cation	s of the	rapeu	tic diet					
Unit-				Conta						T2			
No.		Conte	nt	Hour	r	Lear	ning (	Outcon	ne	K	L		
I	processor ethics and the med asset MN. stress Theorem	Counselling –Defir ess-interviewing, coulting, role of the des, limits.  Iniques for obtaining mation: nutritional ropometry, clinical ical history and genessment- diet history A, FFQ, lifestyles, passionies of counselling, niques	ounseling and detitian, code of grelevant status assessment-information, eral profile, dietary , 24 hr diet recall, ohysical activity,	8	d re a si	earn al ietitian esponsi ssessm tatus ar ounseli	es and	1,2	,3,4				
II	Development of the control of the co	eloping resources are education and couns itional assessment for ulatory and non-am- iking with Hospitalizatients ow up Monitoring a	eling Developing orm (for bulatory patients) zed patients and	8	p c		ng teo g of m ecordi	chnique odified ng to		1,2	,3,4		

#### **REFERENCE BOOKS:**

R1: "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell

R2: "The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

R3: Research Methodology: Methods and Techniques" by C.R. Kothari

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Understand the principles and procedures of diet counseling and the role of the counselor.	1,2,3,8							
2	Give them a clear picture of influence of lifestyle on health and wellbeing.	1,2,3,8							
3	Analyze how acute and chronic illness affects the emotional, psychological well being and behavior of the individuals.	1,2,3,8							
4	Learn the techniques and skill of dietitian	1,2,3,8							
5	Evaluate the significance of dietitian in modifications of therapeutic diet	1,2,3,8							

		}	SEMESTER – V											
Course	Titla	TECH	INO PROFESSIO	ON	AL (	COU	RSE	Ш						
Course	Title	(COMN	IUNITY EXPER	IE	NCE									
Course	code	24BSFDR314R	Total credits: 1	l	L 0	T 0	P 0	S 4	R	0/F 0	C 1			
Pre-req	uisite	Nil	Co-requisite		U	U	<u> </u>	N		0	-			
Progra		Bachelor	of Science in Food	d, l	Nutri	tion	& D	etetic	es					
Semes	ter	Fall/ V se	emester of third y	yeaı	r of t	he p	rogra	ımme	;					
Course Objectives		2. To work with community nutrition	3. To prepare audio visual material for health and nutritional awareness.											
CO	1	Study the community as a concept and the dynamic formation of its structures												
CO2	2	Gain insight regarding the health issues faced in the community and communities												
G02		understanding of their own issues.  Prepare material for health and nutritional awareness.												
CO ₂		Prepare material for health and nutritional awareness.  Explain various national and international health organizations												
CO		Understand the programs in			organ	ıızaıı	OHS							
Unit-	, <u> </u>				ontac	t								
No.		Content			Hour		Lea	rning	Outo	come	KL			
	Conc	Concept of public nutrition:												
I	role o	cionship between health and not public nutritionists in the finand public policy related to not h	elds of health		3	- 1	Learning the concept of public nutrition							
п	of Com Com Type Com	municating with Community of the communication. Definitions of munication. Functions of Constant & Levels of Communication munication: Collecting information and health	nmunication. n. Barriers in nation on		3		Learning about the communication 1,2,							
III	group Prepa	munication Methods: Interpo. Steps in community activity aring visual aids—presentations, information booklets etc.	y planning:		2	ć	liffer			nethod	1,2,3			
IV	Role	litional Media in Communit and use of theatre, folksongs, ing awareness in the commun	puppetry in	4 Learning about community nutrition						cion	1,2,3			
V	Interi Orga	ties & Programs in Nutrition national organizations, Nation nizations, Primary Health Can th Programs in India	nal		3	p			out Nutr	ition	1,2,3 ,4			

T1: Srilakshmi B., Community Nutrition, New Age International Pvt. Limited, First Edition, 2022.

# **REFERENCE BOOKS:**

R1: Temple, N. J. and Steyn, N., Community Nutrition for Developing Countries Athabasca University Press and UNISA Press, 2016

R2: Park, K. Textbook of preventive and social medicine, 27th Edition, 2023.

# OTHER LEARNING RESOURCES:

https://www.researchgate.net/publication/233706475 Health Nutrition and Public Policy

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Study the community as a concept and the dynamic formation of its structures	1,2,3,5,7
2	Gain insight regarding the health issues faced in the community and communities understanding of their own issues.	1,2,3,5,7
3	Prepare material for health and nutritional awareness.	1,2,3,5,7
4	Explain various national and international health organizations	1,2,3,5,7
5	Understand the programs in nutrition & Health	1,2,3,5,7

			SEMESTER -	V										
Course '	Title		RESEARCH PRO	JECT	(MINI	RES	EAR	CH)						
Course	aada	24BSFD317R	Total credits: 2	L	T	P	S	R	O/F	C				
Course	coue	24DSFD31/K	Total Credits. 2	0	0	0	0	12	0	2				
Pre-requ	iisite	Nil	Co-requisite				I	Vil						
Progran	nme	В	Bachelor of Science in Food, Nutrition and Dietetics											
Semes	ter		Fall/V semester of											
Cour	92	1. To enable students to apply experimental methods to solve a given scientific task.												
Object		· ·	2. To be able to analyze research data											
Object	1703	_	3. To be able to compile and document research data.											
CO1 Learn to tabulate research data														
CO2 Analyze research outcomes														
CO3	1	Corelate with exiting	literature											
CO4		Prepare an effective d	_											
CO5	5	Able to communicate	research outcome											
Unit-No.		Cont		Conta		t Learning Outcom			KL					
CIIIC TVO		Content				ur Learning Outcome								
	Intro	duction, Comprehensio	n on research search	,					se search					
I		nes, Selection of Topic.		•	30		_		selection	1,2,3				
								of top	ic.					
		s for reference citation,		or										
		ng citation and reference												
	structure of Review and specific features of review, Plagiarism, ethnical issue in writing the review,					To	learn	to wr	ite reviev	V				
II	_		30					1173						
		ping and selection of Jo	-			of literature for a topi								
		vledge of discipline and	l submission for											
	publi	ications.												

#### **REFERENCE BOOKS:**

R1: "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell

R2: "The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

R3: Research Methodology: Methods and Techniques" by C.R. Kothari

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/

	CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome								
1	Learn to tabulate research data	1,2,3,5,7,8								
2	Analyze research outcomes	1,2,3,5,7,8								
3	Corelate with exiting literature	1,2,3,5,7,8								
4	Prepare an effective dissertation report	1,2,3,5,7,8								
5	Able to communicate research outcome	1,2,3,5,7,8								

			SEMESTER	SEMESTER – VI											
Cours	e Title	1	RESEARCH PROJECT	[PA]	RT I	(DIS	SERTA	TION	)						
Cours	o oodo	24BSFD324R	Total credits: 5	L	T	P	S	R	O/F	C					
Cours	e coue	24DSF D324K	Total credits. 3	0	0	0	0	30	0	5					
Pre-re	quisite	Nil	Co-requisite				N	il							
Progr	amme		<b>Bachelor of Science in</b>	Food	, Nut	rition	and Di	etetics							
Semo	ester		Spring/ VI semester of	third	l yea	r of the	e progr	amme							
Course		1. Apply experimental methods to solve a given scientific task,													
	ctives	2. Collect data for evaluation and for statistical treatment, if relevant,													
Object	ctives	3. Use relevant scientific literature.													
C	01	Develop a research proposal, formulating research questions, reviewing literature,													
		interpreting data, and understanding the implications of research findings.  Develop skills in crafting a concise and well-structured research proposal.													
CC									ւ1.						
CC			ate research questions, ob	-											
CC	)4		ed review of relevant lite												
CC	)5	Learn to interpret data, draw meaningful conclusions, and relate results to the research													
	1	question.													
Unit-		Co	ntent	(	Conta		Learn	ing Ou	itcome	KL					
No.					Hou										
I	Introdu	action, Comprehe	nsion on research search		10				nethods	1,2					
_	engine	s, Selection of To	pic		10	O	f resear	ch		1,2					
			ion, Different methods for	or											
	_		rences, Introduction to												
			specific features of						s on dat						
II	review	, Plagiarism, ethn	ical issue in writing the		20	C	ollection	n and		1,2					

#### **REFERENCE BOOKS:**

for publications

R1: "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell

interpretation

R2: "The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

R3: "Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar.

#### OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037944/

review, Mapping and selection of Journal of

specific knowledge of discipline and submission

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Develop a research proposal, formulating research questions, reviewing literature, interpreting data, and understanding the implications of research findings.	1,2,3,4,5.6,7,8			
2	Develop skills in crafting a concise and well-structured research proposal.	1,2,3,4,5.6,7,8			
3	Learn to formulate research questions, objectives, and hypotheses.	1,2,3,4,5.6,7,8			
4	Conduct a focused review of relevant literature related to the chosen mini research topic.	1,2,3,4,5.6,7,8			
5	Learn to interpret data, draw meaningful conclusions, and relate results to the research question.	1,2,3,4,5.6,7,8			

SEMESTER – VI											
Course T	Title		НЕБ	RBAL	MED	ICINE					
Course c	ode 24FSB	O601B	Total credits: 3	L	T	P	S	R	O/F	C	
		OUUIK	Total hours: 45T	3	0	0	0	0	0	3	
Pre-requ	isite N	il	Co-requisite				Nil				
Program	ıme	Bachelor of Science in Food, Nutrition and Dietetics									
Semest			Spring/ VI semester of					ne			
Cours	Δ Ι	1.To understand the pharmacological properties of medicinal plants.									
Objectiv	2.10 le	2. To learn the methods of formulation of herbal medicine.									
	3.10 ev		cientific literature on herb								
CO1			acological properties of mo								
CO2	_		thods of formulation of he			ie.					
CO3			ific literature on herbal me								
CO4			l applications of herbal me								
CO5	Unders	tand the	legal and ethical issues or	_		icine.				_	
Unit-		Content			tact	Lea	rning (	Outcor	Outcome		
No.				He	our						
	Pharmacolo	harmacological Properties of Medicinal				Describ		1			
	Plants: Intro	Plants: Introduction to pharmacognosy,				pharmacological properties and mechanisms of action of bioactive compounds in					
I	bioactive co	bioactive compounds in plants, mechanisms			9				1,2		
	of action, ex	of action, examples of commonly used									
	medicinal pl	dicinal plants.				medicinal plants.					
	Methods of	ethods of Formulation of Herbal									
			n methods, preparation			Demons			_		
II		extracts, formulation techniques (tinctures,			9	of different extraction and				2,3	
		ecoctions, infusions, tablets, capsules),				formulation technique					
		tandardization of herbal products.				used in herbal medicine.					
	Evaluation	of Scien	tific Literature on			Critical	lvr avra1:	unta an	. d		
	Herbal Med	licine:				Critical	•		ıa		
III	Research me	ethodolo	gies, critical appraisal of	9	9	interpre literatur			orbol	4,5	
	clinical stud	ies, syst	ematic reviews, meta-			medicin		cu to ii	Civai		
	analyses, int	analyses, interpretation of results.									
		_	ns of Herbal Medicine:			Discuss	the cli	nical			
			ine in treating common			applicat		-	and		
IV			ased applications, safety	9	9	efficacy				3,4	
		and efficacy, interaction with conventional				medicin		_			
	medicines.					various	condit	ions.			
	_	Ethical I	ssues in Herbal			Underst	and an	d discu	ISS		
	Medicine:	•	40.			the lega					
V			rks, quality control,	•	9	related				1,2	
	_		rights, ethical			research	_				
			earch and practice,			medicin					
	patient conse	ent.									

T1: "Pharmacognosy and Phytochemistry" by Vinod D. Rangari

T2: "Textbook of Pharmacognosy" by C.K. Kokate, A.P. Purohit, and S.B. Gokhale.

T3: "Herbal Medicine: Biomolecular and Clinical Aspects" edited by Iris F.F. Benzie and Sissi Wachtel-Galor

#### **REFERENCE BOOKS:**

R1: "The Complete Guide to Herbal Medicines" by Charles W. Fetrow and Juan R. Avila

R2: "Principles and Practice of Phytotherapy: Modern Herbal Medicine" by Simon Mills and Kerry Bone

R3: "Herbal Medicine: Expanded Commission E Monographs" by Mark Blumenthal

#### **OTHER LEARNING RESOURCES:**

Coursera, YouTube

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Discuss pharmacological properties of medicinal plants.	1,2,5			
2	Explain the methods of formulation of herbal medicine.	1,2,5			
3	Evaluate scientific literature on herbal medicine.	1,2,5			
4	Discuss clinical applications of herbal medicine.	1,2,5			
5	Understand the legal and ethical issues on herbal medicine.	1,2,5			

SEMESTER – VI										
<b>Course Title</b>		INTERN	SHIP							
Course Code	24BSFD321R	Total Credits: 6		T	P	S	R	O/F	C	
Course Code	24DSF D321K	Total Credits: 0	0	0	0	24	0	0	6	
<b>Pre-requisite</b>	Nil	Co-requisite		•		Nil		•	•	
Programme	Bacl	nelor of Science in Food,	Nutr	ition a	nd D	ieteti	ics			
Semester	Spri	ng/ VI semester of third	year	of the	progi	ramr	ne			
	1. To demonstrate co	omprehensive knowledge	of the	princi	ples o	f me	dical n	nutrition	l	
Course	therapy (MNT) across various disease states									
Objectives	2. To identify and diagnose nutritional deficiencies, risks of malnutrition, and the									
Objectives	impact of nutrition on disease progression.									
	3. To develop and implement individualized nutrition care plans based on patient-									
	specific needs and goals.									
CO1 Understand the impact of disease on nutritional needs, the role of 1										
201	-	gement, and the applicati							nes.	
		a patient's nutritional stat		-				_	-	
CO2	nutritional history, physical examination, biochemical tests, and anthropometric									
	measurements.									
	Setting realistic dietary goals, recommending appropriate dietary interventions (e.g.,									
CO3		ementation, enteral/paren			on), an	ıd pro	oviding	g clear a	and	
concise nutrition education to patients and their families.										
CO4 Effectively communicate with patients, families, and members					bers o	of the	health	ncare tea	am	
	regarding nutrition-r									
CO5	_	aspects of food service op		ns, inc	cluding	g pur	chasir	ng, inve	ntory	
	control, production p	planning, and staff schedu	ling.							

- 1. Frontpage: Name of University, University Logo, Name of the Student, Class, Department
- 2. Certificate
- 3. Acknowledgement
- 4. Contents
- 5. Introduction
- 6. Activities

#### A. Activity I: Internship details

- Name of the Institution where the internship was undertaken
- Dietitian incharge under whose Supervision Internship undertaken (Name and Designation)
- Duration and date of internship
- Dietetic department profile and organization
- Posting schedule of the intern

Day/week	Posting	Activities schedule and undertaken

- Kitchen layout
- Food procurement and storage
- Schedule/timing for meal distribution
- Dietetic department menu

#### B. Activity II: Modified therapeutic diets and special feeding methods

#### C. Activity III: Clinical posting and nutritional care of patients

- i. Ward posting detail
- Major disease conditions observed and Medical Nutrition Therapy recommended during ward posting

Sl. No	Ward posting	Major disease conditions observed	Recommended diets

- ii. Nutrition and diet counseling
- List of educational material available
- Nutrition and diet counseling for both In and Out patients

Date/time	IPD/OPD Posting	Counseling details

Note: Separate table for IPD and OPD

#### D. Activity IV: Case studies

- Disease case

Case problem (indicate the disease condition) Weight (kg)

Food habits

Occupation

Educational qualification

lifestyle

Date of admission

Date of discharge Duration of stay

Medical diagnosis

Past history

#### - Medical history of the case

- Present problem
- Physical parameters examination
- Biochemical parameters

Parameters analyzed	At the time of admission	At the time of discharge	Normal values during the treatment

#### -Management and treatment details

- i. Drug therapy (give the name of the drug/injections etc given/prescribed)
- ii. Blood glucose monitoring (record in tabular form and follow-up the patient's blood glucose level if analyzed before breakfast, before lunch and/or before dinner the period of hospitalization). (note: only for diabetes mellitus)
- iii. Dietary management of the disease condition
- iv. Nutrition/diet counseling

- v. Careprognosis: (comment on the portable course and outcome with respect to patient's condition/after the disease treatment in the hospital)
- vi. Case study outcome: (brief highlights how the case study helped in your understanding of the dietary management of the disease condition under study)

#### A. Activity V: Presentation

7. Annexure/Appendices: Abbreviations, Biochemical Parameters, Portion Size, Diet Sheet



# Assam down town University

# Curriculum and Syllabus

# Master of Science in Food, Nutrition and Dietetics

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.2

# FACULTY OF SCIENCE

July, 2024

# **PREAMBLE**

Assam down town University is a premier higher educational institution which offers Bachelor, Master, and Ph.D. degree programmes across various faculties. These programmes, collectively embodies the vision and mission of the university. In keeping with the vision of evolutionary changes taking place in the educational landscape of the country, the university has restructured the course curriculum as per the guidelines of National Education Policy 2020. This document contains outline of teaching and learning framework and complete detailing of the courses. This document is a guidebook for the students to choose desired courses for completing the programme and to be eligible for the degree. This volume also includes the prescribed literature, study materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated 16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated 26/07/2024

Chairperson, Board of Studies

Member Secretary, Academic Council

Donney

#### Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

#### **Missions**

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

# **Programme Details**

#### **Programme Overview**

M. Sc. FND offers a wide range of courses covering various basic and applied areas of nutritional sciences. The student develops an aptitude and scientific temperament to apply the technical skills in various important areas of Nutrition and Food such as Food Science, Nutritional biochemistry, Food Microbiology, Clinical Nutrition, Food Technology and Food Science. The course also offers various techno specific skills, universal ethics and elective courses considering overall development and employability scopes in research, industry and teaching sectors. The course duration is for a period of 2 years.

#### I. Specific Features of the Curriculum

- Experiential learning
- Constructivist approach to learn
- Practical and project-based learning

#### II. Eligibility Criteria:

M. Sc in FND with minimum of 45% marks or equivalent CGPA.

# III. Program Educational Objectives (PEOs):

**PEO1:** AdtU Food Nutrition and Dietetics post graduates will be equipped to pursue lucrative careers as food analysts, public health nutritionists, food microbiologists, food product developers, food inspectors, and other related fields in both public and private sectors.

**PEO2:** Post graduates in Food Nutrition and Dietetics will have the academic preparation to work as certified dietitians or diet counsellors, assessing nutritional status and promoting health.

**PEO3:** Food Nutrition and Dietetics post graduates from AdtU will actively engage in professional efforts to uplift their status in the field of higher education/research in specialized or multidisciplinary fields while also positively impacting society and the profession. If they choose to continue further education

#### **IV. Program Specific Outcomes (PSOs):**

**PSO1:** Global Proficiency: Manifest global proficiency in the profession with self-paced skill development and continuous learning.

**PSO2: Research and outreach:** Encourage the pursuit of problem-solving through research, collaborate with national and international organizations that specialize in nutrition and related multi-disciplinary subjects, and raise public awareness through outreach and extension.

**PSO3:** Entrepreneurship: Empower competency to construct a profitable business as an entrepreneur to pursue careers in domain and multidisciplinary fields to establish a successful venture.

#### V. Program Outcome (PO):

- **PO1**. Nutritional Knowledge: Apply comprehensive knowledge of food science, nutrition, dietetics, allied aspects of biological sciences, and nutrition specialization to solving complex human nutritional issues.
- **PO2.** Problem Analysis: Identify and analyse complex nutritional problems reaching substantial conclusions using life science fundamentals and nutrition using critical thinking.
- **PO3.** Reasoning and Research: Apply multidisciplinary knowledge and research methods including review of literature, hypotheses formulation, experimental design and analysis using modern tools and analytical techniques to provide valid conclusions.
- **PO4**. Communication: Communicate effectively the information and nutritional intervention with individuals, peers, and society at large; prepare documents/ scientific reports and deliver presentations efficiently.
- **PO5**. Professional Ethics: Comply with moral values, professional ethics, and their strict application in the professional practice.
- **PO6.** Eco-Friendly Approach: Understand the impact of the formulated nutritional solutions in a socioeconomic context with eco-friendly approaches.
- **PO7.** Teamwork and Leadership: Function effectively as an individual, and as a member or leader in multidisciplinary teams.
- **PO8.** Lifelong Learning: Ability to engage in independent lifelong learning in the broadest context of scientific and technological advancement.

#### VI. Total Credits to be Earned: 89

#### **VII. Career Prospects:**

M.Sc. in Food Nutrition and Dietetics offers a range of dynamic career opportunities. Graduates can work in research and development, hospitals, and food processing industries. Roles include nutritionist, quality control analysts, and clinical researchers. Opportunities also exist in academia and education, where graduates can contribute to scientific knowledge and train future professionals.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting in-semester (Sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

S.N.	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (Sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

# **III. Pattern of Question Papers**:

The question paper shall follow the principles of Bloom's Taxonomy.

S. N.	Level	Questions /verbs for test
1 Damamhan		List, Define, tell, describe, recite, recall, identify, show who, when,
1	Remember	where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare
3	Evaluate	etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

**Table 1: Question paper pattern for End semester examination** 

Sl no.	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

#### **IV. Examination Duration:**

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

**Table 2: Letter Grades and Grade Points** 

Letter Grade	Grade Points	Description
0	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
С	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

# iv. Grade Point Average:

# a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

# b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

CGPA = 
$$\frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii)The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### **D.** Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Redressal Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Re-evaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

# INSTRUCTION TO TEACHERS AND STUDENTS

#### (Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

# 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d.** Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In

addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

# The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of	
teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

# Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

# SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code	Course Title	Course	F	Eng	gag	gen	ıer	nt		Maximum Marks for			
	N.			Category	L	T	P	S	R	O	С	IA*	SEE*	PE*	Total
	1.	24MSFD1101R	Advance food Science	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSFD1102R	Biochemistry and Bio-instrumentation	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Semester I	3	24MSFD1103R	Food Microbiology	DSC Minor	3	0	2	0	0	0	3	40	60	0	100
Seme	4	24UMFS1101R	Fundamental of Statistics	MDC	1	0	2	0	0	0	2	40	60	100	200
	6	24UMPD1101R	Effective Communication (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	7	24UMEC1101	Extra-Curricular Activities	Co and Extra- Curricular	0	0	0	4	0	0	1	0	0	100	100
		То	tal								16				900
	S. No.	Course Code	Course Title	Course Category	Engagement				Maximum Marks for						
	110.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSFD1201R	Macronutrients	DSC Major	3	0	0	0	0	0	3	40	60	0	100
	2	24MSFD1202R	Human Physiology	DSC Major	3	0	0	0	0	0	3	40	60	0	100
	3	24MSFD1203R	Micronutrients	DSC Major	2	0	0	0	0	0	2	40	60	0	100
	4	24MSFD1204R	Public nutrition	DSC Major	3	0	2	0	0	0	4	40	60	100	200
r II	5	24UMPD120R	Aptititute / Logical Course	AEC	2	0	0	0	0	0	2	40	60	0	100
Semester II	6	24MSFD1205R	Postgraduate Practice Teaching	SEC	2	0	0	0	0	0	2	0	0	100	100
Se	7	24FSDA1201R	Data Analysis using microsoft excel	VAC	2	0	4	0	0	0	2	0	0	0	100
	8	24MSFD1208R	Research methodology & Statistical Analysis	Research	2	0	2	0	0	0	3	40	100	100	200
	9	24MSFD1206R	Field Visit	Field Training	0	0	0	0	0	8	1	40	60	0	100
	10	24UMCC1201		Co- Curricular	0	0	0	0	0	0	1	0	0	100	100
	11.	24MSFD1207R	Food Safety and Standards	DSC- Minor	1	0	0	0	0	0	1	40	60	0	100
		То	tal								24				1300

	S.	Course Code	Course Title	Course	F	Eng	gag	gen	ner	ıt		Maxi	mum M	Iarks	
	No.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	24MSFD2101R	Advance Nutrition	DSC Major	3	0	0	0	0	0	3	40	60	0	100
	2	24MSFD2102R	Applied nutrition I	$\begin{array}{c c} \mathbf{DSE} & & & \\ & 3 & 0 \end{array}$		2	0	0	0	4	40	60	100	200	
		24MSFD2103R	Clinical Nutrition I	Major											
	3	24MSFD2104R	Applied nutrition II	DSE Major	3	0	2	0	0	0	4	40	60	100	200
er ]		24MSFD2105R	Clinical Nutrition II	Major											
Semester III	4	24MSFD2106R	Product development and Marketing	DSC Major	3	0	0	0	0	0	3	40	60	0	100
	5		English (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	6		Internship	Internship	0	0	0	0	0	0	4	0	0	100	100
	7		Project Dissertation	Research	0	8	0	0	0	0	4	0	0	100	100
			Indian Knowledge Systems	VAC	0	0	0	0	0	0	2	0	0	100	100
	8		Field Visit	Field Training	0	0	0	0	0	0	1	40	60	0	100
		To	tal								27				1100

	S. N.	Course Code	Course Title	Course Category		Ξn	ga	gei	me	nt		Maxi	mum M	Iarks	
N	14.					T	P	S	R	О	C	IA*	SEE*	PE*	Total
Semester I	1	24MSFD2201R	Internship	DSC Major	0	0	0	0	0	48	6	40	60	0	100
Sem	7	24MSFD2202R	Research/data analysis/documentation- R4	Research	0	0	24	8	12	0	16	0	0	100	100
	Total									22				200	
	Grand Total									89				3500	

*IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

	SEMESTER – I												
Course T	Title	MACR	ONU	TRIENT									
Comman	ada 24MCED1201D	Total credits: 3	L	T	P S	R	O/F	С					
Course c	ode 24MSFD1201R	Total hours: 45T	3	0	0 0	0	0	3					
Pre-requ	isite Nil	Co-requisite			N	il							
Program	ıme	<b>Master of Science in 1</b>	Food	Nutrition a	and Diet	etics							
Semest	er	Fall/ I Semester of fi	irst y	ear of the p	rogram	me							
Cours	Δ	e students to the basics											
Objectiv	2. To study the ba	sic food groups, cookin	ig me	thods in det	ails.								
	3. To learn the ne	w concept of nutrients											
CO1		e on different macronut											
CO2		Learn about different macronutrient deficiency and the related causes											
CO3	-	Understand the program and policies in connection to food and health											
CO4	Understand body of	Understand body composition and recommended dietary allowances for different age											
	groups												
CO5	Gain knowledge o	n the sources of differen	nt nut	rients									
Unit-	Co	Content				ning ()	utcome	KL					
No.				Hour	Bear		utcome	IXL					
	Introduction to Nutrit												
	*	istory, and nutrition research in India. Methods											
	-	determining human nutrient needs and											
	-	escription of basic terms and concepts in											
		elation to human nutritional requirements.											
					Learn about								
	Recommended Dietary Allowances, factors affecting RDA, methods used to derive RDA,				Under								
	-			compo									
_	determination of RDA f		10	recomi	1,2								
I	_	equirements and allowances.				allowances for different age groups							
	-	Body Composition - Significance of body											
		omposition and changes through the life cycle.  Methods for assessing body composition (both			change	s throu	gh the						
	classical and recent) and	•			life cy	cle.							
	Energy - Components o	* *											
	BMR, RMR, thermic ef		1										
	activity. Factors affecting												
	methods of	.8 ee.8) requirements,	,										
	Measuring energy expense	nditure.											
	Estimating energy requi				Estima	ting en	ergy						
-	and groups. Regulation			-		ments		1.0					
II	and body weight: Contr	••	of	7	_	luals an		1,2					
	leptin and other hormon	leptin and other hormones			groups								
	Carbohydrates - Revie	ew of nutritional											
	significance of carbohy	significance of carbohydrates and changing											
	trends in dietary intake			Unders	stand								
III	·	carbohydrates and their implications.				onal		1,2					
111	<b>Dietary fibre</b> : Types, sources, role and mechanism			10	significance of			1,2					
	of action. Resistant stard				carbohydrates								
	other oligosaccharides:	-	and										
	physiological significan	ice.											

	Glycemic Index and glycemic load.  Deficiency and excess of carbohydrates, its			
	relation to human health.			
	<b>Proteins</b> – Metabolism of Protein, overview			
	of role of muscle, liver and G.I. tract in protein metabolism, Nutritional requirements.			
			Understand nutritional	
IV	Amino acid – Essential and Non-essential of	9	significance of Protein	1,2
	amino acids, therapeutic applications of		significance of Floteni	
	specific amino acids, Peptides of physiological			
	significance. Proteins and Applied Aspects:			
	Protein Quality.			
	Lipids – Metabolism of fat, Nutritional			
	significance of fatty acids – SFA, MUFA,		Understand nutritional	
V	PUFA: functions and deficiency. Role of n-3	9	significance of Lipid	1,2
	and n-6 fatty acids. Prostaglandins and trans		significance of Lipid	
	Fatty			

T1: Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (1998): Modern Nutrition in Health and Disease. 9th edition. Williams and Williams. A Beverly Co. London.

#### **REFERENCE BOOKS:**

R1: Annual Reviews of Nutrition. Annual Review Inc, California, USA.

R2: Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New York

R3: Sumathi, R., Mudambi, Rajagopal, M.V. (1997) Fundamentals of Foods and Nutrition, New Age International (P) Ltd, Publishers, Third edition.

R4: Bamji, M. S., (2009) Textbook of Human Nutrition, Oxford, IBH Publishing (P) Ltd, 2009.

#### OTHER LEARNING RESOURCES:

SWAYAM, Coursera, Research articles

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Acquire knowledge on different macronutrient.	1,2						
2	Learn about different macronutrient deficiency and the related causes	1,2,4						
3	Understand the program and policies in connection to food and health	1,2,4						
4	Understand body composition and recommended dietary allowances for different age groups	1,2						
5	Gain knowledge on the sources of different nutrients.	1,2						

			SEMESTEI	R – I										
Course 7	Title		HUMAN	PHYS	SIOL	OGY								
Course c	ode	24MSFD1102R	Total credits: 3	L	T	P	S	R	O/F	C				
			Total hours: 45T	3	0	0	0	0	0	3				
Pre-requ		Nil	Co-requisite				N							
Program			Master of Science in											
Semest	er		Fall/ I Semester of f					me						
		<ol> <li>To introduce the students the basics of human physiology.</li> <li>To understand how the various physiological function of different parts of the body</li> </ol>												
Cours				ologica	ıl fun	ction of	differ	ent pai	ts of the t	ody				
Objecti	ves	and there metab				. : <b>1</b>		J.,						
G04			ne metabolism of diffe		stem	s in nun	nan bo	ay.						
CO1			sics of human physiol	<u> </u>										
CO2			ctioning of the various	us parts	of th	e body	and th	e nutri	ent uptake	from				
		the food	.1 1 1 1 1		•,			1	1					
CO3		· ·	e on the rheological p	ropertie	es, its	measu	rement	and it	s applicati	ion to				
		food  Gain knowledge er	n ganaral amagnings	n oter-ci	h1140 -	nd n===	onti	of all 4	ho creaters	a in				
CO4		our body	n general organization	ıı, struci	iure a	ınu prop	perties	oi ali t	ne system	is in				
CO5		•	ply the knowledge of	avarcio	a on	haalth								
Unit-		Onderstand and ap	pry the knowledge of	Conta		ncarm				1				
No.		Conte	nt	Hou		Le	earnin	g Outo	come	KL				
1100	Con	eral Physiology: O	rganization of	IIUUI		Hour		11001						
I		man body, cell structure and organelle,				Understand basic								
_		ies and functions.	ire and organiene,	6		organization of human body								
		Blood: Blood volume and body fluids,												
		omposition and functions of blood,				Learn a	hout s	tructur	<b>a</b>					
II		tructure and formation and function of				composition and functions								
		BC, WBC and platelets, Haemoglobin,				of blood		ina ran	CHOILS	1,2				
		ma, blood coagulation												
		estive System: Gene												
	_	nizational plan of di												
	_	ement of G.I. Tract	•											
	vari	ous components, Co	mposition,			T	h a.u.4 F	\: ~ ~ ~4:-						
III	func	ctions and regulation	of salivary,	10		Learn a		ngesuv	/e	1,2				
	gast	ric, pancreatic, intes	tinal and biliary			System								
	secr	etion, Functions of l	iver, gall bladder											
	and	pancreas, Digestion	and absorption of											
		ohydrate, protein an								<u> </u>				
		piratory System: G												
	_	nization, Mechanics	-					_						
IV	_	ulation of respiration		10		Learn a		espirat	tory	1,2				
		nange in lunge and ti	•			System								
		ilation, volumes and												
		ect of exercise on res												
		diovascular system												
		eral organization, str				Learn about Cardiovascular								
V		perties of cardiac mu		12				.aru10V	ascular	1,2				
	_	out, cardiac cycle, co				System								
		eart, Heart sounds, r	-											
	puis	e, blood pressure an	a its regulation,											

Systemic circulation, pulmonary		
circulation and coronary circulation,		
ECG, cardio respiratory		
Changes during exercise.		

T1: Meyer B J, Meij H S and Meyer AC., Human Physiology, AITBS Publishers and Distributors T2: Wilson, K. J. W and Waugh, A. (1996): Rossand Wilson, Anatomy and Physiology in Health and Illness, 8th Edition, Churchill Livingstone

#### **REFERENCE BOOKS:**

R1: Ranganathan, T.S. (2004): A Textbook of Human Anatomy, Chand and Co. N.Delhi.

R2: Jain, A.K., Textbook of Physiology, Vol.I and II, Avichal Publishing Co., New Delhi.

R3: Chatterjee C.C. (1987): Human Physiology, Vol.I and II, Medical Allied Agency, Calcutta

#### OTHER LEARNING RESOURCES:

SWAYAM, Coursera, Research articles

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Understand the basics of human physiology	1,2						
2	Understand the functioning of the various parts of the body and the nutrient uptake from the food	1,2						
3	Provide knowledge on the rheological properties, its measurement and its application to food	1,2						
4	Gain knowledge on general organization, structure and properties of all the systems in our body	1,2						
5	Understand and apply the knowledge of exercise on health	1,2						

	SEMESTER – I											
Course	Title		NUTRITIONAL									
Course	code	24MSFD1103R	Total credits: 3 Total hours: 45T	L	T	P	S	R	O/F	C 3		
Pre-rec	uriaita	Nil		3	0	0 0 0 0 0						
	`		Co-requisite  Master of Science in F	lood i	Ninterit	ion on						
Progra Seme		1	Fall/ I Semester of fir									
Senic	Stei	1 To review about	the different biochemi						nody.			
Cou	rse		ow this metabolism tak						-			
Objec	tives		fferent pathways involve	_					nutrents.			
CO	1		sics metabolic reaction									
GO.	_	Give a clear picture	e of the biochemical Pa	arame	eters of	f the bo	dy in	normal	and diseas	se		
CO	2	condition.										
CO	2	Understand the con	ncept of solutions of so	lid in	liquid	and lic	luid i	n liquid	and			
CO	3	the properties relat	ed to the concentration	of so	olute.							
CO	4	Learn about differen	ent pathways involved	in nut	trient 1	netabol	ism					
CO	5	Learn about fluid a	and electrolyte balance									
Unit-			Content			Cont	Contact Learning			KL		
No.		,	Content			Hou	ır	Out	tcome	KL		
		<u> </u>	on, classification. Struc									
			le- Glucose, fructose a									
_	_		Maltose, lactose and su		e;		<ul><li>Learn about</li><li>Metabolism of</li></ul>					
I	•		nd glycogen. Metaboli			9				1,2		
	-	colytic pathway, electron transport chain and oxidative phorylation. Metabolism of carbohydrates: glycolysis						carbohy	ydrates			
		•			lysis							
		<u> </u>	CA) cycle, HMP shunt.									
			ification, structure, phy	ysıcaı								
	• •	oolism of proteins:-	erties and utilization.									
		-	tion, decarboxylation, u	ıraa								
		·	nzymes- Definition, typ					Learn a	about			
II	-	•	affecting velocity of en		<b>.</b>	10		Metabo		1,2		
			ostic value of serum er	•				of prote	ein			
	-	-	ne phosphatase, Acid									
		hatase, LDH, SGO										
		e, Carbonic anhydra	•									
	Lipid	s- Definition, classic	fication and properties.					Learn a	bout			
III	Metab	oolism- Oxidation a	nd biosynthesis of fatty	acid	s.	7		Metabo	olism	1,2		
	Keton	e bodies, ketogenes	is and ketosis.					of lipid	l			
	Acid -	– base balance- Ac	id-base balance in norm	nal				Learn a	hout			
	health	, definition of buffe	rs, principles of buffers	s, maj	jor			acid ba				
		-	in the body, physiologi					balance				
IV	-		nt buffer systems. <b>Flui</b>			10	1	Fluid a		1,2		
		=	ibution of fluids in the	body	,	electroly						
		ICF, Water metabol						balance	•			
		dration Maintenance										
			n, general mode of acti					Learn a				
V		•	yroid, Parathyroid, Ad		s,	9		general		1,2		
	_		ncreas, hormonal disord	iers,				functio				
	counte	er regulatory hormor	ies.					hormor	ies			

T1: Deb.A. C., Fundamental of Biochemistry, New Central Book Agency (P) Ltd, reprint 2004

# **REFERENCE BOOKS:**

R1: Pattabiraman. T. N. Concise text Book of Bio-Chemistry, 2nd edition, All India Publishers and Distributors, Regd., 1998.

R2: Ambika Shanmugam, Fundamentals of biochemistry for Medical students, Karthik Printers, 7th edition, 1992.

## **OTHER LEARNING RESOURCES:**

SWAYAM, Coursera, Research articles

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Understand the basics metabolic reaction of the body.	1,2,				
2	Give a clear picture of the biochemical Parameters of the body in normal and disease condition.	1,2				
3	Understand the concept of solutions of solid in liquid and liquid in liquid and the properties related to the concentration of solute.	1,2,3				
4	Learn about different pathways involved in nutrient metabolism	1				
5	Learn about fluid and electrolyte balance	1,2				

		SEMESTER	- I									
Course T	Title	ADVANCE		D SC	IENC	CE CE						
~	1 41 5055 440 45	Total credits: 4	L	Т	P	S	R	O/F	С			
Course c	code 24MSFD1104R	Total hours: 45T+30P	3	0	2	0	0	0	4			
Pre-requ	isite Nil	Co-requisite				]	Nil	1	· ·			
Program	nme	Master of Science in F	ood N	Vutri	tion a	nd Di	etetics					
Semest	er	Fall/ I Semester of fin	st ye	ar of	the p	rograi	nme					
Cours	1. To study differ	ent food group and their	compo	onent								
Objectiv	12 To study physi	2. To study physical and chemical properties of food										
Objecti	3. To study the va	rious cooking methods of										
CO1		to advance food science	and fu	ınctic	on of o	differe	nt kinds	s of				
	foods, its compos	ition and classification										
CO2		edge of toxic components										
CO3		pply the knowledge of fo		trient	by se	electing	g foods					
		od groups in planning of o										
CO4		processing and storage sk										
CO5	Develop culinary	skills to satisfy sensory a				.S						
Unit-	C	ontent	Contact Learning Outcom			Contact   Learning Outcom			KL			
No.	Canala ahamiaturu Ctu	watuma aammasitian	1	10ur	-							
	Cereals chemistry: Str nutritive value of cere	•										
		-	n									
		akfast cereals, Characteristics of starch, use in iety of preparations Pulse chemistry:				To learn about structure, composition and nutritive						
I		demical composition, Selection and variety,							1,2			
1	_	in variety of preparation, nutritional aspects				_		cereals and pulses				
		cost, effect of cooking & storage on nutritive					cerears	and puises				
		constituents of pulses,	, 6									
	Lathyrism.	constituents of pulses,										
		x & Milk Products: Composition & nutritive										
		ties and effect of heat,			To	learn	about					
II		critional importance. Milk Processing, Milk					composition and nutritive					
	products, Substitutes,						milk		1,2			
	Role of milk in cooke						value of mink					
		osition & nutritive value,										
	-	indication of freshness										
	-	le meat, composition &										
		on of meat, postmortem					•					
		ooking, storage, factors		40			about 1	• •				
III	effecting tenderness o			10		•		d nutritive	1,2			
	~	osition, nutritive value,			V	ilue of	Poultry	y & Fish				
		eggs, uses of egg in food										
	_	f egg Baking - Types of										
	bake products & its nu											
		Classification, composition	n									
	& nutritive value, imp	•		To learn about t		types,						
***	nutrition, storage, coo			10				d nutritive	1.5			
IV	~	and fruits on cooking,	value of vege				1,2					
		t alkali. Phytonutrients in				uits	<i>U</i>					
	fruits and vegetables	<b>,</b> 1 1 <del>1</del>										
L	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								1			

	Spices and Condiments: Types, uses in Indian			
	recipe Beverages: Coffee, tea, and cocoa,			
	processing composition and preparation			
	Nuts & oilseeds, Nutritive value of commonly			
	used nuts & oil seeds in our diet, Fats& Oils-			
	Nutritive values, types of fats & oils, role of fat		To learn about types,	
<b>X</b> 7	in cookery.	0	* *	1.2
V	Sugar and Related Products: Nutritive value,	8	composition and nutritive	1,2
	Properties, characteristics & uses, sugar cookery,		value of Nuts & oil seeds	
	Form of sugar and liquid sweetness,			
	Caramelization, Hydrolysis, Crystallization.			
	Standardization of Cereal and pulses recipe and			
	determine the nutritive value			
	Standardization of egg, meat and product recipe			
	and determine the nutritive value			
<b>X7X</b>	Standardization of vegetables, spices and fats		To apply theoretical	1,2,3,
VI	and oil recipe and determine the nutritive value		knowledge	4
	Market survey on different types of cereals and			
	pulse (s)	45		
	Market survey on different types of meat and			
	milk products			

T1: Norman N. Potter and Joseph H. Hotchkiss, Food Science, CBS publishers and distributors, Fifth edition, 2000

## **REFERENCE BOOKS:**

R1: Manay Shakunthala, Nand Shadaksharaswamy M. Foods facts and Principles, New Age International (P) Ltd Publishers, Reprint 2005.

R2: Srilakshmi B. Food Science, New Age International (P) Ltd Publishers, Third edition, 2005.

# **OTHER LEARNING RESOURCES:**

SWAYAM, Coursera, Research articles

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Introduce student to advance food science and function of different kinds of foods, its composition and classification	1,2					
2	Apply the knowledge of toxic components in legumes and other food items	1,2					
3	Understand and apply the knowledge of food nutrient by selecting foods from different food groups in planning of diet.	1,2,4					
4	Gain home scale processing and storage skills to retain nutrients	1,2					
5	Develop culinary skills to satisfy sensory and nutrient needs	1,2,7					

SEMESTER – I										
Course	e Title		FUNDAMENTA	L OF	STA	ATISTIC	CS			
Course	e code	24MSFD1201R	Total credits: 3	L	T	P	S R	O/F	C	
			Total hours: 45T+30P	2	0	2	0 0	0	3	
Pre-rec	-	Nil	Co-requisite	1 3 7	4 •4	• 1	Nil			
Progra			Master of Science in Fo							
Seme	ester	1 17 1	Fall/ I Semester of firs					1 '		
		research	and the role of statistics in	n data	anai	ysis, aec	ision-maki	ng, and sci	ientific	
			ente to descriptive statistic	a inal	ludin	a maasu	ess of sontr	al tandana	* 7	
Cou	rse		ents to descriptive statistic , mode) and measures of d			-			У	
Objec	etives	deviation).	, mode) and measures of c	nsper	SIOII	(range, v	arrance, sta	iiuaiu		
		,	how to summarize and pr	acant	data	offoctive	dy ucina tal	hlac chart	c and	
		graphs	now to summarize and pr	esent	uata	ciicciive	ary using ta	oies, ciiai i	s, and	
CC	)1	• •	standing of Descriptive St	atistic	e and	d Demog	ranhy			
			edge to understand the Pr					and sampl	ling	
CO	2	methods.	eage to understand the Fr	ooaoi	nty t	ncory, D	isa ioutioil,	ana sampi	mg	
			edge to understand the mo	ethods	s for	hypothes	is testino a	nd biologi	cal	
CO	)3	data analysis.	2000 to anderstand the line	ou	, 101	J Poulos	woming a	olologi		
CO	)4	•	edge to understand the pri	incipl	es of	various	statistical a	nalyses of	data.	
CO	)5	,	edge on R language for da							
Unit-		*				Contact	Lear	ning		
No.			Content			Hour	Outc	_	KL	
	Statist	ical Methods: Def	inition and scope of Statis	tics,			Foundation	onal		
I	conce	pts of statistical po	pulation and sample. Data	ı:		5	Understar	nding	1,2	
1	quanti	tative and qualitati	ive, attributes, variables, s	cales	of	5	of Statisti	cal		
			rdinal, interval and ratio.				Concepts			
			graphical, including histog	-						
	_		Central Tendency: mathem				Proficienc	•		
II	_	ional. Measures of Dispersion: range, quartile deviation,					Data Pres		1,2	
			deviation, coefficient of v	ariatio	on,		and Analysis	ysis		
		ess and kurtosis	sport and discussion of the original	- 1 - 1	01		V	~ 0.7		
			n scatter diagram, simple, p		and		Knowled	_		
III	_	tiple correlation (3 variable only), rank correlation,					Analyzing Bivariate		1,2	
	_	ple linear regression, fitting of polynomials and onential curves					Relations			
	_		al, sample point and samp	e sna	ce		Terations	mps		
		_	ents, concepts of mutually	_						
		*	Definition of probability: c							
			proach. Discrete probabi				Understa	nding of		
IV			, Independence of events,	<i>y</i> P	,	8	Probabilit	-	1,2	
	_	_	total and compound				Distributi	•	,	
		-	l probability Distribution,							
			istribution, Poisson Proba	bility						
		-	rem and its applications.	-						
			arametric test: t-test, z-test				Applicati	on of		
$\mathbf{v}$	_		tric test: One sample Kolr	nogor	ov	7	Hypothes		1,2	
•		_	st, Mann-Whitney Test,			,	Testing a		1,4	
	Krusk	alwalis test					Statistical	Tests		

1. Introduction to R - A programming language and environment for data analysis and graphics. Syntax of Rexpressions: Vectors and assignment, vector arithmetic, generating regular sequence, logical vector, character vectors, Index vectors; selecting and modifying subsets of data set  2. Data objects: Basic data objects, matrices, partition of matrices, arrays, lists, creating and using these objects; Functions-Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes. matrices, partition of matrices, arrays, lists, creating and using these objects; Functions-Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3. Importing data files: import. Data function, read. Table function; Exporting data: export. data function, cat, write, and write. table functions, function, formatting output options, and format functions; Exporting graphs -export. graph function. Graphics in R: creating graphs using plot function, box plot, histogram, line plot, steam and leaf plot, pie chart, bar chart, multiple plot layout, plot titles, formatting plot axes; Visualizing the multi variate data: Scatterplot, Q-Qplot, P-Pplot.  4. Performing data analysis tasks: Reading data with scan function, Exploring data using graphical tools, computing descriptive statistics, one sample tests, two sample tests, Goodness of fit tests.  5. Parametric test and Non-Parametric test	30	A brief knowledge on using R for data analysis and visualization	1,2, 3,4
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----	------------------------------------------------------------------	-------------

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Improve understanding of Descriptive Statistics and Demography.	1, 3, 4				
2	Develop knowledge to understand the Probability theory, Distribution, and sampling methods.	1, 4				
3	Develop knowledge to understand the methods for hypothesis testing and Biological data analysis.	1,4				
4	Develop knowledge to understand the principles of various statistical analyses of data.	1,4				
5	Develop knowledge on R language for data analysis	1, 4				

	SEMESTER – I								
<b>Course Title</b>	EFFEC'	TIVE ENGLISH (Co	nmuı	nicativ	ve Eng	lish &	Soft S	Skills)	
Cauras ands	24UMPD1101R Total credits: 2 L T P S R O				O/F	C			
Course code	24UNIPDITUIR	Total hours: 60P	0	0	4	0	0	0	2
Pre-requisite	Nil	Co-requisite				Ni	il		
Programme	N	Master of Science in F	ood N	Nutriti	ion an	d Diet	etics		
Semester		Fall/ I Semester of fin	rst year of the programme						
	1.To introduce the types of sentences and their significance.								
Commo	2.To strengthen the students' vocabulary to enhance their speaking and writing skills.								
Course Objectives	3.To familiarize the	3.To familiarize the students with the importance of dress codes in various organizations.							
Objectives	4.To introduce the 3	P's (Planning, prioritizin	ng & p	erforn	ning) of	Time	Manag	gement.	
	5.To give insight int	o English pronunciation	and in	nto cen	ıtral coı	ncepts	in phon	etics.	
CO1	This course will ena	ble students to analysis a	nd ide	entify t	he diffe	erent ty	pes of	sentences.	
CO2	Learners will be ab	le to integrate the skill	s of re	eading	and sp	eakin	g in pr	ofessional	
COZ	communication.								
CO3	Dress code Etiquette	e sessions will boosts the	eir confidence and morals.						
CO4	Students will earn al	out the effective and eff	icient	utiliza	tion of	time.			
CO5	Introduction to Phor	netics and its importance	will ii	mprov	e the le	arners'	pronui	nciation	

#### Module 1- Grammar

- i. Interchange of Interrogative and Assertive Sentences, Exclamatory and Assertive Sentences
- ii. Types of Tenses
- iii.Common Errors
- iv. Synonyms
- v. Antonyms
- vi. Homonyms

## Module 2- Reading Skills

- i. Techniques of Effective Reading
- ii. Gathering ideas and information from a text The SQ3R Technique Interpret the text

## **Module 3-Listening Skills**

- i. What is listening?
- ii. The Process of Listening
- iii. Factors that adversely affect Listening
- iv. Difference between Listening and Hearing,
- v. Purpose and Importance of Effective Listening
- vi. How to Improve Listening Process,

## **Module 4- Conflict Management**

i. Definition

I

- ii. Type of Conflict Management
- iii. Effects of Conflict Management
- iv. Methods to deal with Conflicts (Negative)

#### **Module 5- Time-Management Skills**

- i. Introduction To Time Management,
- ii. Purpose And Importance of Time Management,
- iii.Basic Tips to Maintain Time.

Activity: Problem solving activity: A situation will be given to the students and they will have to tell us how to handle the situation or solve the problem.

Page | 23

T1: Wren, P. C and Martin, H. 1995. *High School English Grammar and Composition*, S Chand Publishing.

T2: English Grammar in Use, Raymond Murphy 4th edition, CUP.

T3: Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

## **REFERENCE BOOKS:**

R1: English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.

R2: Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

## OTHER LEARNING RESOURCES:

https://www.classcentral.com/report/toefl-preparation/https://brightlinkprep.com/10-best-toefl-prep-books/

	CO PO Mapping						
S N	Course Outcome (CO)	Mapped Program Outcome					
1	Analyse and identify the different types of sentences.	1, 4					
2	Able to integrate the skills of reading and speaking in professional communication.	1, 4, 7					
3	Illustrate code Etiquette sessions will boost their confidence and morals.	4,7,8					
4	Describe about the effective and efficient utilization of time.	4,7					
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	1, 4,7					

	SEMESTER – I								
<b>Course Title</b>	Course Title MINI RESEARCH (R1)								
Course code	24MSFD1105R	Total credits: 2	L T P S R O/F			C			
Course code	24WISFD11U5K	Total credits: 2	0	0	0	4	6	0	2
<b>Pre-requisite</b>	Nil	Co-requisite		Nil					
Programme	N	laster of Science in Foo	l Nutri	tion a	nd Die	etetics			
Semester		Fall/ I Semester of first	year of	ear of the programme					
	1. Appreciate and u	nderstand the importance	of importance of various research writing						
Course	and review.								
Objectives	2. Applying the tech	nniques and skill for writi	ng Abst	ract, s	hort c	ommu	nicatio	ns.	
	3. To develop techni	cal writing skills.							
CO1	Develop competence	e in writing and abstracti	ng skill						
CO2	Learn to write litera	ture and review							
CO3	Develop competence	e in Project proposal	oposal						
CO4	Acquired the knowl	edge to conduct scientific	project	project					
CO5	Analyze the signific	ant aspect of scientific pr	oject						

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Develop competence in writing and abstracting skill	1,2					
2	Learn to write literature and review	1,2					
3	Develop competence in Project proposal	1,2					
4	Acquired the knowledge to conduct scientific project	1,2,3					
5	Analyze the significant aspect of scientific project	1,2,3					

			SEMESTER –	II								
Course T	itle		MICRON	UTRIE	NT							
Course co	odo	24MSFD1201R	Total credits: 3	L	T	P	S	R	O/F	C		
			Total hours: 45T	3	0	0	0	0	0	3		
Pre-requi		Nil	Co-requisite			Nil						
Program			Master of Science in Foo									
Semeste	er		oring/ II Semester of fir									
			portance of micronutrien						1.0	c .		
Course		-	e requirements and impo	ortance o	of dif	ferent n	nicron	utrien	ts in dif	terent		
Objectives		stages of life  3. To understand about putrient interactions in human body.										
601		3. To understand about nutrient interactions in human body.  Acquire knowledge on different micronutrient.										
CO1			nt micronutrient deficien		ho r	alatad as	211000					
CO2												
CO4		Understand the program and policies in connection to food and health Understand interaction with other nutrients										
CO5			on water and electrolyte	e halance	<b>.</b>							
Unit-				Contac				_				
No.		Cont	tent	Hour		Lear	ning	Outco	ome	KL		
	Fat	t Soluble Vitamins (	A, D, E and K)									
	His	storical background, l			Tr. 1	1	· F · 6	. 1 11				
I	Me	etabolism and functio	10			To learn about Fat Soluble Vitamins			1,2			
	oth	er nutrients, Require	ments, Deficiency and			vitamin	S					
	tox	icity.										
			ns (B complex and C)									
		storical background, l			To learn	abou	t wate	r	1,2			
II		etabolism and functio	10		Soluble Vitamins							
		er nutrients, Require										
		icity.										
			cium and Phosphorus,									
		Magnesium, c. Sodiu	m, d. Potassium,									
III		Chloride) storical background, l	Food sources	10		To learn	abou	t macı	o	1,2		
111		etabolism and function		10		minerals	3			1,2		
		er nutrients, Require										
		icity.	ments, Beneroney and									
		cro Mineral (a. Iron	, b. Copper,									
		Manganese, d. Iodine.										
	g. \$	Selenium, h. Cobalt, i	i. Chromium,									
IV	j. N	Molybdneum)		7		To learn	abou	t micr	0	1.2		
1 1 1	His	storical background, l	Food sources,	_ ′		minerals	3			1,2		
	Me	etabolism and functio										
		er nutrients, Require										
		icity										
		•	Balance-Distribution									
V		body water, ECF/ICF	8		To learn about water and				1,2			
			ons, thirst mechanism,		-	electrolyte						
	wa	ter/electrolyte balanc	e, water-Imbalance									

T1: Sumathi R. Mudambi, Rajagopal, M.V., Fundamentals of Foods and Nutrition, New Age International (P) Ltd, Publishers, Third edition, 1997.

#### REFERENCE BOOK

- R1: Indian Council of Medical Research. Recommended Dietary Intakes for Indians Latest Recommendations.
- R2: Indian Council of Medical Research. Nutritive Value of Indian Foods Latest Publication.
- R3: Annual Reviews of Nutrition. Annual Review Inc, California, USA.
- R4: Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy) Hardcover Illustrated, 7 July 2016.
- R5: Srilakshmi, B. Nutrition Science, New Age International (P) Ltd, Publishers, 2004.
- R6: Bamji, M.S., Textbook of Human Nutrition, Oxford, IBH Publishing (P) Ltd, 2009.
- R7: WHO Technical Reports eries.
- R8: Indian Council of Medical Research. Recommended Dietary Intakes for Indians Latest Recommendations.

#### OTHER LEARNING RESOURCES:

SWAYAM, Coursera, Research articles

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Acquire knowledge on different micronutrient.	1,2
2	Learn about different micronutrient deficiency and the related causes	1,2
3	Understand the program and policies in connection to food and health	1,2
4	Understand interaction with other nutrients	1,2
5	Acquire knowledge on water and electrolyte balance	1,2

			SEMESTER – I	T								
Course	Title		NUTRITIONAL B		EMIS	STRY	-II					
		• 43 5GFD 4 • 0 • D	Total credits: 4	L	T	P	S	R	O/F	С		
Course	code	24MSFD1202R	Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-req	uisite	Nil	Co-requisite		u.		Nil					
Progra	mme		Master of Science in Foo	d Nut	trition	and ]	Dieteti	cs				
Seme	ster		Spring/ II Semester of fir									
Cou	rse		t the different biochemical now this metabolism takes						•	of the		
Objectives		food										
		3.To understand the biochemical alterations in deficiency disorders.										
CO	1	Understand the basics metabolic reaction of the body.										
СО	2	Give them a clear picture of the biochemical Parameters of the body in normal and disease condition										
CO	3	Understand bioche	Understand biochemistry behind chromosomal disorders									
CO	4		Gain knowledge of biochemical alteration in deficiency disorders									
CO	5	Understand bioche	emical aspects of some vit	al con	nponei	nts						
Unit- No.		Cor	ntent		ontact Iour	L	earnin	g Ou	tcome	KL		
	Introduction- DNA, RNA, Genetics					Lea	rn abo	ut				
I	Bioch	Biochemistry behind chromosomal disorders:					Biochemistry behind					
1	Down	syndrome, Triple-Y	X syndrome, Turner		10		omoso	mal		1,2		
	_	ome, trisomy18, tris				disc	orders					
		radicals and reacti										
	stress	and disease, source	es, markers of oxidative			Learn about Free						
II		<b>xidants</b> : types and		8	rad	1,2						
		se system, combatin			oxygen species							
		ve oxygen species	6									
			s: types, functions, active			Lea	ırn abo	ut typ	es and			
III	sites,	factors affecting, ki	netics and inhibition, use		10	fun	ction o	f Enz	ymes	1,2		
	in inv	estigation, role of c	oenzymes			_	coenz					
	Bioch	emical alteration i	in deficiency disorders:				ırn abo					
IV		VADD/ Anaemia,	•		7		chemic			1,2		
	osteoi	nalacia, beri-beri, p	ellagra, scurvy				ration iciency		rders			
	Bioch	emical aspects of s	some vital components:									
		-	glandins, lipoproteins,				ırn abo					
V		ga-3 fa, Hb, glycoci			10		chemic ome vi		pects	1,2		
	immo	noglobulins, elastin										
	kerati					COII	nponen	1.0				
	_	litative Tests for Ca										
	_	litative Tests of pro					_			1,2,		
VI	_	litative test for Lipi			40	Plan and carry out						
	_	litative determination	-			exp	experiments					
			operties of the enzyme									
	urea	ise and Achromatic	time of salivary amylase									

T1: Deb. A.C., Fundamental of Biochemistry, New central book agency (P) Ltd, reprint 2004.

# REFERENCE BOOK

R1: Pattabiraman. T. N. Concise text Book of Bio-Chemistry, 2nd edition, All India Publishers and Distributors, Regd., 1998.

R2: Ambika Shanmugam, Fundamentals of biochemistry for Medical students, Karthik printers, 7th edition, 1992

# **OTHER LEARNING RESOURCES:**

SWAYAM, Coursera, Research articles

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the basics metabolic reaction of the body.	1,2
2	Give them a clear picture of the biochemical Parameters of the body in normal and disease condition	1,2
3	Understand biochemistry behind chromosomal disorders	1,2
4	Gain knowledge of biochemical alteration in deficiency disorders	1,2
5	Understand biochemical aspects of some vital components	1,2

	SEMESTER – II											
Course	Title		PUBLIC HEAL	TH N	UTR	TIC	N					
Course	oodo	24MSFD1203R	Total credits: 4	L	T	P	S	R	O/F	С		
Course	coue	24MSFD1203K	Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-reg	quisite	Nil	Co-requisite				Ni	l				
Progra	mme		Master of Science in Foo	d Nu	ıtritio	n an	d Dietet	ics				
Seme	ster	Spring/ II Semester of first year of the Programme										
		1. To study about different aspect of nutrition and health.										
Cou	rse	2. To study about the importance of child and maternal health.										
<b>Objectives</b>		3. To understand the nutritional problems and learn the programmes to combat the										
		problems.										
CO	)1	Understand the di	fferent aspects of commur	ity h	ealth.							
CO	2	Give them a clear	picture of importance of h	ealth	progr	ams	polices	related	l to mat	ernal		
CO	· <u>4</u>	and child health										
CO	3	Apply the knowle	dge of nutrition science to	hum	an hea	lth a	cross th	e life s	pan.			
CO	1	Comprehend the l	knowledge on nutritional p	roble	ems an	d co	mplicati	ons on	comm	unity		
	·-•	level										
CO	5	Learn about nutrit	ional programmes running	g in g	lobal a	is we	ell as in	India				
Unit-		Ca	ntent	(	Contac	et ,	[ aawain	a Out	00000	KL		
No.		Co	ment		Hour	.   '	Learnin	g Out	come	KL		
	Nutri	tion and health: N										
	indica	tor, nutrition relate										
	well a	s in India- deficien										
	Maln	utrition: Causes, e										
	Preva	lence, epidemiolog	ı		1	Learn ab						
	defici	ency- A, B1, B2, N				Nutrition						
I	progra	ammes to combat, I		10		ndicato	artir	1,2				
		uorosis- Prevalence				nalnutri						
		ammes to control.			1	iidiiidii i						
		MMR, Mortality, n										
		tio and poverty leve										
			ices and their role in									
	_	nting communicabl										
			Ith: Nutritional care in									
		-	by , LBW, Programmes of			]	Learn ab	out				
**		nization, Nutritiona	•		0	]	Nutrition	n care i	n	1.0		
II		-	act of diet on outcome of		8	]	Pregnan	cy and		1,2		
		ancy, MCH					actation	-				
			es: Infant feeding, safety									
		•	utrient supplements.	-								
		sment of nutrition										
			, clinical symptoms of				Learn ab	ovt				
III		eficiency disorder. <b>Nutrition education:</b> Merits, planning, evaluation					Learn ac			1,2		
1111		onduct, educational		10					1,2			
		unication media, ir			'	assessme	/11t					
		child feeding prac										
			development, national	$\perp$			Have an	incich	tor			
IV			objectives, guidelines and		7			_	UII	1,2		
1 4			c distribution system,	·	1							
	unust	arcas. FDS - FUUII	distribution system,				national					

	Agricultural planning - New strategies.		development, national nutritional policy	
v	Nutrition intervention programmes: Objectives, operation of feeding programmes. ICDS.  National organizations - ICMR, NIN, NNMB, ICAR, CFTRI, NIPCCD, NHM, FSSAI.  International organizations-FAO, WHO, UNICEF, UNESCO, World Bank.	10	Have an insight on Nutrition intervention programmes	1,2
VI	<ol> <li>Conduct socio-economic survey</li> <li>Conduct diet survey</li> <li>Conduct clinical examination: Planning, conducting and Evaluating</li> <li>Nutrition Education Programme</li> <li>Impact of Government health programmes</li> </ol>	40	Interpret and apply nutrition	1,2,3,

T1: B. Srilakshmi, Nutrition Science New Age International (CP) Ltd, New Delhi, 2002.

# **REFERENCE BOOK:**

R1: Mahtab, S. Bamji, N. Pralhadrao, Vinodini Reddy, Textbook of Human Nutrition, Oxford and IBIT Publishing co Pvt. Ltd, New Delhi, reprint 1999.

R2: Shukla, P. K., Nutritional problems of India, 1982.

## OTHER LEARNING RESOURCES:

SWAYAM, Coursera, Research articles

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the different aspects of community health.	1,2
2	Give them a clear picture of importance of health programs polices related to maternal and child health	1,2
3	Apply the knowledge of nutrition science to human health across the life span.	1,2
4	Comprehend the knowledge on nutritional problems and complications on community level	1,2,3
5	Learn about nutritional programmes running in global as well as in India	1,2

			SEMESTER	– II										
Course T	itle	F	OOD MICROBIOLO	OGY	AND	FOOI	SAF	ETY						
Course c	odo	24MSFD1204R	Total credits: 3	L	T	P	S	R	O/F	C				
Course c	oue	24MSFD1204K	Total hours: 45T	3	0	0	0	0	0	3				
Pre-requi	isite	Nil	Co-requisite					Vil						
Program	me	N	<b>Taster of Science in F</b>	ood N	Nutrit									
Semeste	er		oring/ II Semester of					mme						
		•	fferent microbiologica											
Course			principles of food pres					-						
Objectives		3. To understand the positive and negative reaction of the microbes on food and human health.												
CO1			erent principles of food	d safe	tv.									
CO2			icture of role in food p			and fo	od spo	oilages	 _					
CO3			ge of microbiology on						· ·					
CO4		** *	les of Food Preservati		•		•							
CO5			on food safety enforce											
Unit-		•			tact									
No.		Conte	ent	Ho	ur	Learning Outcome				KL				
	Food and Microorganisms- food as a													
	sub	strate for microorgan												
	mic	roorganisms in food												
		eral principles under			Learn about Food and									
I	Foo	od Contamination-	1	0		1,2								
	pres	servation and spoilag			Micro									
	veg	etables and fruits/ me												
	pro	ducts/ milk and milk												
	pro	ducts												
	Pri	nciples of Food Pres	servation- asepsis,											
II	rem	noval, anaerobic conc	lition, preservation	8	2	Learn	about	Princi	iples of	1,2				
11	by l	high temperature/lov	v temperature/	,	,	Food 1	Preser	vation		1,2				
	dry	ing/ food additives/ r	adiation											
		ods and Enzymes Pr	_			Learn	about	Foods	s and					
III		<b>croorganism</b> s- produ		1	0	Enzyr				1,2				
		d fermentation, foods	s and enzymes from	_		Micro			a oj	1,2				
		roorganisms				1/11010								
		<u>-</u>	food borne illnesses,		_									
IV		-bacterial food poiso	7	7	Learn	about	Food	toxicity	1,2					
		oxication, food borne												
		od Sanitation, contr	<del>-</del>											
			gy in food sanitation,			Learn about Food Sanita								
V		orcement and control	-	1	U	control and Inspection				1,2,3				
		ernational/ federal/ sta	_					r						
	mic	robiological criteria	tor food											

T1: Frazier, W.C, Food Microbiology, McGraw Hill Publications, New York, 4th Edition, 1998.

# REFERENCE BOOK

R1: Doyle, M.P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2020). *Food microbiology: fundamentals and frontiers*. John Wiley & Sons.

R2: Fields, M. L. (1979). Fundamentals of food microbiology. AVI Publishing Co. Inc.

R3: Matthews, K. R., Kniel, K. E., & Montville, T. J. (2017). *Food microbiology: an introduction*. John Wiley & Sons.

#### OTHER LEARNING RESOURCES:

SWAYAM, Coursera, Research articles

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the different principles of food safety.	1,2,3,8
2	Give them a clear picture of role in food preservation and food spoilages.	1,2,3,8
3	Apply the knowledge of microbiology on food product development	1,2,3,8
4	Know about principles of Food Preservation by using different methods	1,2,3,8
5	Acquire knowledge on food safety enforcement and control agencies	1,2,3,8

			SEMESTE	R – II								
Course 7	Γitle		TECHNIQU						,	_		
Course	code	24MSFD1205R	Total credits:	1 ∟	$\frac{\mathbf{L}}{0}$	T 0	P 2	S 0	R	O/I 0	7	C 1
Pre-requ	isite	Nil	Co-requisite		U	U	<b>4</b>		U Nil	U		
Progran			Master of Science in Food Nutrition and Dietetics									
Semest		Spring/ II Semester of first year of the Programme										
Course Objectives  CO1  CO2  CO3		packaging 2. To develop comp. 3. To understand dif To provide comprel packaging. Understand packagi Learn effect of varie	2. To develop comprehensive understanding of different packaging tests.  3. To understand different types and forms of packaging.  To provide comprehensive overview of the scientific and technical aspects of food									
		*						•				
CO4 CO5		Develop compreher Acquire knowledge				•				mma duna	<b>t</b> o	
Unit-		1 0		Conta	_	ckagi						
No.		Conten	Content				Lear	ne		KL		
I	func Nee	coduction: Important etion of food packaging d of food packaging e of packaging in extension.	ng,	3		Learn basics of packaging					1.	,2,3,4
п	(con ther Met cons Plas	es of packaging mate astruction of jars and mal and mechanical jal (types of base met struction of metal car tics- substituted olefi- lene, PET, polyamid	bottles, optical, properties of glass), al sheets, as, lacquering), ans, tetrafluro	3		Learn types of packaging					1.	,2,3,4
Ш	Food packaging systems, product characteristics and package requirements.  Introduction of food packaging system. Different forms of packaging. Rigid, semi-rigid, flexible forms of packaging.  A but the characteristics and packaging system.  Justice of packaging systems are characteristics and packaging systems.  Justice of packaging systems are characteristics and packaging systems.  Justice of the characteristics and packaging systems.  Justice							1.	,2,3,4			
IV	food fruit	ls, Frozen foods, Dai s, Vegetables, Meat,	rent packaging system for-Dehydrated s, Frozen foods, Dairy products, Fresh s, Vegetables, Meat, Poultry, Sea foods.					_	kaging rent foo		1	,2,3,4
V	Pack pack Ase	cage accessories and caging technology-In caging, Modified atm ptic packaging, Pack as, Biodegradable platings.	troduction, Active asphere packaging, ages for microwave		Learn about packaging system for different food						1.	,2,3,4

T1: Gordon L. Robertson, Food Packaging: Principles and Practice, Third Edition, 2013.

T2: Gordon L. Robertson, Food Packaging and Shelf Life: A Practical Guide, 2010.

# REFERENCE BOOK

R1: Ruben Hernandez, Susan E. M Selke, John Culter, John D. Culter, Plastics Packaging: Properties, Processing, Applications, and Regulations, 2000.

R2: Walter Soroka, Fundamentals of Packaging Technology-Fourth Edition,

## **OTHER LEARNING RESOURCES:**

SWAYAM, Coursera, Research articles

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	To provide comprehensive overview of the scientific and technical aspects of food packaging.	1,2,6,7
2	Understand packaging machinery, systems, testing and regulations of packaging.	1,2,6,7
3	Learn effect of various environmental factors on the stability of food Comprehend the knowledge on nutritional problems and complications	1,2,6,7
4	Develop comprehensive understanding of different packaging tests	1,2,6,7
5	Acquire knowledge on importance of selective packaging related to food products.	1,2,6,7

			Semester II								
Course Title		COMMUNICATI	ON MASTERY (Con	nmui	nicati	ve En	glish &	& Sof	t Skills)	)	
Course code		IUMPD1201R	Total credits: 2	L	T	P	S	R	O/F	C	
Course code	24	IUMPD1201K	Total hours: 60P	0	0	4	0	0	0	2	
Pre-requisite	Ef	fective English	Co-requisite				Nil				
Programme		Master of Science in Food Nutrition and Dietetics									
Semester			g/II Semester of first y								
			s with the transformati	on of	sente	ences a	and the	appr	opriate ı	use of	
_	_	prepositions.									
Course			g skills in different are			-				ting.	
objectives		3. To convey meaning by reinforcing, substituting for, or contradicting verbal									
		nmunication.		• . • .		с .	,				
001			ormance boosting activ				onal go	oal ac	hieveme	nt.	
CO1			g questions, and idioms								
CO2			ferent sentence types an								
CO3			aphs, precis, and profe								
CO4			s, goal setting, and per					es.			
CO5	Illust	rate non-verbal cor	mmunication and body		iage o	concep	ots.				
Unit		TT CD !!!	Conte	nt							
35 33 4		Use of Preposition	1S								
Module 1-		Tag questions	1.01								
Grammar		Idioms, Phrases an									
M - J-1- 2			compound sentences								
Module 2-		Active and Passiv									
Grammar		Direct and Indirec	ting; avoid ambiguity	and r	0.011.01	2000					
Module 3-		Paragraph Writing		anu v	aguei	1688					
Writing		Precise Writing	3								
Skills		Letter Writing									
SKIIIS		Resume, CV and	Cover Letter								
Module 4-			Cover Letter								
Self-		SWOT Analysis									
Management		Self-Regulation- (	Goal Setting								
Skills	III.	Personal Hygiene									
36 3 3 6	I.	What is Non-Verb	oal Communication & 1	Body	Lang	uage,					
Module 5-	II.	Elements of Com	nunication,	·							
Non- Verbal	III.	Types of Body La	nguage,								
Communica tion-	IV.	Importance and In	npact of Body Languag	ge,							
Sciences of	V.	Types of Commun	nication through Body	Lang	uage,						
Body	VI.	Introduction to Ha	aptic, Introduction to K	inesi	es						
Language	VII.	VII. Introduction to Proxemics,									
	VIII.	Body Language D	o's and Don'ts, Doubt	Clea	ring S	Session	n.				
Module 6-		Importance,									
Group		-	ts, and Skills assessed;								
Discussion		Effectively disagr	•								
(Theory)	IV.	Initiating, Summa	rizing and Attaining th	e Obj	jectiv	e					

T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

T2: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

## **REFERENCE BOOK:**

R1: Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky, 2019

R2: A Textbook for AECC English Communication: Interface, Dr. Kironmoy Chetia and Pranami Bania Breez Mohan Hazarika, January 2019

## **OTHER LEARNING RESOURCES:**

https://youtu.be/x60GHpQ8gJk https://youtu.be/Ke_oSN-BCaY https://youtu.be/TDPDtrLxT-c

https://www.classcentral.com/report/toefl-preparation/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Practice of grammar will polish their writing skills.	4,2,8				
2	It will enhance their communication and interpretative skills.	4,2,8				
3	Introduction to behavioural skills, thoughts, and emotions will enable them to behave in a conscious and productive way.	2,4,5				
4	It will have a positive impact in their thought process and problem-solving skills.	2,4,5				

			SEMESTER – II							
Cours	se Title	UNIVERSAL	HUMAN VALUES (UH							7
Cours	se code	24UUHV2101R	Total credits: 2	L	T	P	S	R	O/F	C
			Total hours: 15T+30P	1	0	2	0	0	0	2
	-requisite Nil Co-requisite Nil									
	ester	Master of Science in Food Nutrition and Dietetics								
Sciii	CSCI	er Winter/ II Semester of first year of the Programme  1. To help the students appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' and 'VALUES' are serious appreciate the essential complementarily between 'VALUES' are serious appreciate the essential complementarily appreciate the essentialy appreciate the essential complementarily appreciate the essenti								l' and
	urse ctives	'SKILLS' to ensure of all human being 2. To facilitate the de and profession as wunderstanding of the perspective forms to based living in a nata. 3. To highlight plausi human conduct, true enriching interactions.	s sustained happiness and ps sevelopment of a Holistic pervell as towards happiness are Human reality and the rathe basis of Universal Humatural way ble implications of such a statul and mutually fulfilling	erspect and pr est of nan Va Holisi	rity, w ive an osperii Existe alues a tic und nan be	nong s ty bas nce. S nd mo	are the studented on Such a coverned anding in and in and in and in and in a coverned and in an analysis and an analysis analysis and an analysis and an analysis and an analysis and an analysis analysis and an analysis and an analysis and an analysis analysis and an analysis and an analysis and an analysis and analysis and an analysis and an analysis and an analysis analysis analysis and an analysis analysis and an analysis analysis analy	ts tova a cor holisent to in ter mutu	vards li rect stic wards v ms of e	fe value-
C	01		and rational study of the				•	•		
	O2	<u>_</u>	gma or value prescriptions							
C	O3	•	-investigation and self-exp							
	O4 O5	Whatever is found as truth or reality is stated as a proposal and the students are facilitate to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.  This process of self-exploration takes the form of a dialogue between the teacher and to students to begin with, and then to continue within the student leading to continuous self-exploration.						nd the		
Unit No.		evolution.	Content							
NO.	• Unde	rstanding the need ha	sic guidelines, content and	1 proce	ess for	Valu	e Educ	ratio	1	
	• Self I Valid	Exploration—what is it lation—as the mechanis	? - its content and process; sm for self exploration Prosperity- A look at basi	; 'Natı	ıral Ac	ccepta	nce' a			tial
I	of asp • Unde • Meth	pirations of every hum rstanding Happiness a od to fulfil the above l	ionship and Physical Facil an being with their correct and Prosperity correctly- A human aspirations: unders	t prior	ity al app	raisal	of the	curr	ent scei	nario
П	<ul> <li>levels.</li> <li>Understanding human being as a co-existence of the sentient 'I' and the material 'Body'</li> <li>Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha</li> <li>Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)</li> <li>Understanding the characteristics and activities of 'I' and harmony in 'I'</li> <li>Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail</li> <li>Programs to ensure Sanyam and Swasthya-Practice Exercises and Case Studies will be taken up in Practice Sessions.</li> </ul>									
III	• Unde	erstanding Harmony ir	n the family – the basic uni nman-human relationship;					progr	am for	its

fulfilment to ensure Ubhay-tripti;

- Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
- Understanding the meaning of Vishwas; Difference between intention and competence
- Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!-Practice Exercises and Case Studies will be taken up in Practice Sessions.
- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence-Practice Exercises and Case Studies will be taken up in Practice Sessions.
- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
- Ability to utilize the professional competence for augmenting universal human order
- Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
- Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
- At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- At the level of society: as mutually enriching institutions and organizations

**UNIT 1**: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

#### **PS 1:**

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them. Expected outcome: the students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

# Guidelines and Content for Practice Sessions

IV

 $\mathbf{v}$ 

#### **PS 2:**

Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. – all these seem to be man-made problems threatening the survival of life on Earth – What is the root cause of these maladies & what is the way out in your opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, armsrace, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc — what do you think, is the root cause of these threats to human happiness and peace — what could be the way out in your opinion?

Expected outcome: the students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living. Any solution brought out through fear, temptation or dogma will not be sustainable.

#### **PS 3:**

- 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of
- i) What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect?
- ii) What is Naturally Acceptable to you to nurture or to exploit others? Is your living the same as your natural acceptance or different?
- 2. Out of the three basic requirements for fulfilment of your aspirations- right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

#### Expected outcome:

- 1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
- 2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- 3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

**UNIT 2:** Understanding Harmony in the Human Being - Harmony in Myself! **PS 4:** 

List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.

Expected outcome: the students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too.

#### **PS 5:**

- a. Observe that any physical facility you use, follows the given sequence with time :
   Necessary & tasteful→ unnecessary & tasteful → unnecessary & tasteless
   →intolerable
  - b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!
- 2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.

3. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

#### Expected outcome:

- 1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.
- 2. the students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body.
- 3. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

#### **PS 6:**

- 1. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilisation of the body.
- 2. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases.

Expected outcome: The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

**UNIT 3:** Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

#### **PS 7:**

Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:

- 1a. Do I want to make myself happy?
- 2a. Do I want to make the other happy?
- 3a. Does the other want to make him happy?
- 4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

- 1b. Am I able to make myself always happy?
- 2b. Am I able to make the other always happy?
- 3b. Is the other able to make him always happy?
- 4b. Is the other able to make me always happy?

What is the answer?

#### Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention& competence as well as the others' intention & competence.

Expected outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We

generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

#### **PS 8:**

- 1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of underevaluation, over-evaluation or otherwise evaluation.
- 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected outcome: The students are able to see that respect is right evaluation, and only right evaluation leads to fulfilment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

#### **PS 9:**

- 1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
- 2. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children

Expected outcome: The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

**UNIT 4:** Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

#### **PS 10:**

List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders.

Expected outcome: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participation(in terms of nurturing, protection and right utilization) in the nature.

#### **PS 11:**

- 1. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in the existence.
- 2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are able to make out how these courses can be made appropriate and holistic.

**UNIT 5:** Implications of the above Holistic Understanding of Harmony at all Levels of Existence

#### **PS 12:**

Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected outcome: The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

#### **PS 13:**

- 1. Suggest ways in which you can use your knowledge of Technology/ Engineering/ Management for universal human order, from your family to the world family.
- 2. Suggest one format of humanistic constitution at the level of nation from your side. Expected outcome: The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.

#### **PS 14:**

The course is going to be over now. Evaluate your state before and after the course in terms of

a. Thought b. Behaviour and c. Work d. Realization

Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

Expected outcome: The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for a happy and prosperous society.

#### **TEXT BOOKS:**

T1: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

#### REFERENCE BOOK

R1: PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers. Lucknow. Reprinted 2008.

R2: Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,1991

R3: Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

R4: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.

R5: Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.

R6: A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.

R7: E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

R8: A.N. Tripathy, 2003, Human Values, New Age International Publishers

#### OTHER LEARNING RESOURCES:

Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in Story of Stuff, http://www.storyofstuff.com Al Gore, An Inconvenient Truth, Paramount Classics, USA Charlie Chaplin, Modern Times, United Artists, USA IIT Delhi, Modern Technology – the Untold Story

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.	5,6,7,8				
2	It is free from any dogma or value prescriptions.	5,6,7,8				
3	It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it, based on their Natural Acceptance and subsequent Experiential Validation.	5,6,7,8				
4	This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.	5,6,7,8				
5	This self-exploration also enables them to critically evaluate their preconditionings and present beliefs.	5,6,7,8				

			SEMESTER	– II							
Course T	itle	I	Research Methodolo	gy and	Sta	atistica	al Ana	lysis			
Course co	nde	24UMRM1201R	Total credits: 2		L	T	P	S	R	O/F	C
			Total hours: 15T+	60S	1	0	0	4	0	0	2
Pre-requi		Nil	Co-requisite					Nil			
program			laster of Science in F								
Semeste	er	-				r of the programme					
Course objectiv		methodology, including theoryo: 2. The course seeks through research develop skills for research.	fscienceandqualitative to enhance the studer literature review in dispreparation of a reservats competency in plants.	eandqu nts' skii ifferent arch pr	anti lls f t doi ropo	tativer for dev main. ( sal for	nethodelopin Consecta	dsinre ng crit quent ster' t	searchical the ly, it a	h. ninking nims to project/	
CO1		Students will have b	asic knowledge of Re	search	me	thods.					
CO2			e knowledge of Rese				y.				
CO3		Students will be able	e to gain the Skill que	stionna	aire	develo	pmen	t.			
CO4		Students will be able	e to acquire the know	ledge o	f ba	sic Re	port/d	issert	ation	Procedu	ire.
CO5		Knowledge on differ	rent IPR rights								
Unit no.		Conte	nt	Conta Hou		Ι	Learni	ing O	utcon	ne	KL
I	mea mot sign rese defi	earch Methodology- aning and objectives of civation in research, ty- nificance of research, earch. Defining the Re- anition of research pro- taining research problem	of research, ypes and criteria of good esearch Problems- oblem, necessity of	2		Knowledge on fundamental concepts of research methodology, including the meaning and objectives of research				1,2	
II	rese diff San San sele desi Exp of H	earch Design- meani- earch design, features erent research design appling Design- steps apple Size determination ecting a sampling aign, different types of perimental Design, Presperiment, One – way y ANOVA, CRD, RE torial Design	of a good design, s, in sampling design, on, criteria for sampling design, inciples of Design ay ANOVA, Two-	4		Able to understand and apply the fundamental principles of research design, including the meaning and necessity of research design			1,2		
III	Typ tool inte con sem stat prep of s	pes of data, sources of als of data collection, I rval and ratio — Attitu struction and measur- nantic differential (SE istical analysis, Scheo	Nominal, ordinal, ude scale ement, rating scales, 0), Use of scale in dules for interviews ization, development	3		A good knowledge on different types of data and identify various sources and tools for data collection			1,2		

IV	Planning and organizing research report, Format of research report, Different steps of writing report, lay out of the research report, How to organize thesis/Dissertation, mechanics of writing research report, standard methods of quoting- presenting the result, written and oral reports, Uses of abstract, format of research report, presentation of statistics - tabular and graphic references and uses of references, Bibliography and presentation of bibliography	3	Able to organize and write a comprehensive research report	1,2
V	Intellectual property right (IPR), Introduction and the need for IPR, IPR in India and worldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications, Patentable and non-patentable, patenting life, Filing of a patent application, The different layers of the international patent system, Case studies on Basmati rice, Turmeric, and Neem patents	3	Knowledge on importance of Intellectual Property Rights (IPR) both in India and globally	1,2
Practical	Laboratory using R Software:  1 Analysis of One way ANOVA;  2 Analysis of Two way ANOVA;  3 Analysis of CRD  4 Analysis of RBD  5 Analysis of 22 and 23 Factorial Experiment  6 Simulation-I using R (Bernoulli, Binomial, Poisson and Geometric distribution.).  7 Simulation-II using R (Exponential and Normal distribution).  8 Simple random Sampling  9 Stratified Random Sampling	60	Knowledge on various statistical experiments and simulations using R	1,2,3 ,4

## REFERENCE BOOK

R1: Boyle JS. Styles of ethnography. In: JM Morse, editor. Critical issues in qualitative research methods.

R2: Thousand Oaks, CA: Sage, 1994:159–85.

R3: Coughlan M., Cronin P. and Ryan F. (2007). Step-by-step guide to critiquing research. Part 1: quantitative research. British journal of Nursing 16 (11).

R4: Creswell, JW. (1998). Qualitative Inquiry and Research Design Choosing Among Five Traditions.

R5: Thousand Oaks, CA: Sage Publications.

R6: Crotty, M. (1998). The Foundations of social research: Meaning and perspective in the research process. London: Sage.

R7: Denzin, NK. (1978) Sociological Methods. New York: McGraw-Hill.

R8: Hanson WE, JW Creswell, VL Plano Clark, KS Petska and JD Creswell. Mixed Methods Research

R9: Designs in Counseling Psychology. Journal of Counseling Psychology, 2005, Vol. 52, No. 2, 224–

R10: 235 http://www.preciousheart.net/chaplaincy/Auditor_Manual/13casesd.pdf

R11: 7 Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn & Bacon

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Students will have basic knowledge of Research methods.	2,3
2	Students will gain the knowledge of Research Methodology.	2,3
3	Students will be able to gain the Skill questionnaire development. Students will be able to acquire the knowledge of basic Report/dissertation Procedure.	2,3

		SEN	MESTER – III							
Cours	e Title	PERSO	ONAL FINANCIAL	PLANN	ING					
Course	o Codo	24UUFL1202R	Total Credits: 1	L	T	P	S	R	O/F	C
Course	e Code	24UUFL1202R	<b>Total Hours: 30P</b>	0	0	2	0	0	0	1
Dro- Da	equisite	Introduction to Financial	Co-requisite	Nil						
116- K	equisite	<b>Budgeting And Planning</b>	Co-requisite			1,	411			
Progra	ammes	Master of Sc	cience in Food Nutri	tion and	Diete	etics				
Sem	ester	Fall/ III Ser	mester of second yea	ar of the	prog	ram				
		1. The course would offer an in	* *						epts o	of
		money, borrowing, lending, tax				_	-	-		
	ırse	2. Assess the personal financia	al planning process, th	ne life cy	cle of	finar	ncial	plan	s, and	d
Obje	ctives	methods of goal achievement.								
		3. Formulate a budget, record-	keeping system, and	tax planr	ing st	trateg	y ba	sed o	on	
		current financial goals.								
CO		Explain the cash management					es.			
CO		Discuss a diversified investme								
CO		Compare mutual funds, ETFs,								
CO		Develop a financial plan for re								
CO	<u> </u>	Describe financial products and	d strategies for long-	term goa	ls					
Unit no.		Content		Contact Hour	Lea	rnin	g Ou	ıtcor	ne   I	KL
		<ul> <li>Fundamentals of Financial Patients of money;</li> </ul>	Planning —							
		ation- Meaning, causes, how it c		Students will be able			ole			
		cess official planning,	6	to comprehend the					2 3	
I	_	ne value of money-simple and co	ompound interest:	U		amer				2,3
		Present Value and Future value.			financial planning.					
		ver of Compounding;	,							
		bubling period and Rule of 72.								
	Unit 2	- Income Tax Planning-								
		ning of Income,			Stud	ents	will 1	be		
	ii. Dire	ect & Indirect Taxes, Taxable In	come, various heads		able	to un	ders	tand		
II	of Inco	ome for tax Calculation,		6	and	utiliz	e the	basi	ic 1	1,2
	iii. Noi	n-taxable Income,		aspects of in				ome		
	iv. Tax	evasion and tax avoidance,			tax a	ınd G	ST.			
	v. GST	T, Tax Planning Strategies.								
		- Entrepreneurial planning –								
	i. Mear	ning of Entrepreneurship, prerec	quisites for							
		ing an entrepreneur,			Stud	ents v	will l	be ab	ole	
		repreneurship Support Systems i			to ur	iderst	and	the		
III		titutional support systems for en	_	6		ept, s	_		l   1	1,2
		ancial support systems for entre	preneurs;		pre-requisites of					
		ture Capital, Business Angels,			entre	pren	eursł	nip.		
		istant of Government,								
		mmercial Bank Loans and Over								
		-Planning for investing in secu				ents v			ole	
		stment avenues offered by Secur		_		alyze				
IV		y Market and Secondary Marke		6		pret t				3,4
		k market- meaning, features, fu	nctions of NSE,			ension				
	BSE D	EMAT trading account,			mark	cet in	vestr	nent	.	

	iii. Security repository, stock brokers, Operational aspects of securities markets: placement of orders, contract note, pay-in and pay-out, trading and settlement cycle, iv. Various risks involved in investing in securities markets; Role of Financial Intermediaries; Stock indices. v. Mutual Funds- meaning concept, definition, types, importance and drawbacks of mutual funds, mutual funds in India, investing in mutual funds, vi. Systematic Investment Plan (SIP) and its advantages.			
V	Unit 5- Planning for debts and Retirement i. Consumer credit - Introduction to consumer credit; choosing a source of credit, the cost of credit alternatives, ii. Consumer Legal Protection; iii. Housing Decision: Factors and Finance; Vehicle Decisions. iv. Retirement planning - Meaning of cost of living; retirement need analysis; development of retirement plan, various retirement schemes, v. Estate Planning; Pension and Medicare Planning; Wills.	6	Students will be able to evaluate the aspects of retirement planning to formulate effective strategic financial plans.	1,2,3

- T1: Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million-Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by David J. Mullen Jr
- T2: Personal Finance and Planning by Dr. Rajni
- T3: Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh
- T4: Be Your Own Financial Advisor: Financial Planning, Investment Options, Risk Management, Tax Management, Succession Planning Kindle Edition y Sushil Bali
- T5: The Dumb Things Smart People Do with Their Money: Thirteen Ways to Right Your Financial Wrongs Kindle Edition y Jill Schlesinger

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain the cash management and buying plan for homes or automobiles.	5				
2	Discuss a diversified investment portfolio for different objectives.	1				
3	Compare mutual funds, ETFs, and real estate investment options.	2, 5				
4	Develop a financial plan for retirement and estate protection.	1				
5	Describe financial products and strategies for long-term goals	5				

		SEMESTER -	- III							
Course Ti	tle	CLINICAI	LNU	JTRI	TION	I				
Course co	de 24UMRM1201R	Total credits: 4		L	T	P	S	R	O/F	С
Course co	240WIKWI120IK	Total hours: 45T+3	0P	3	0	2	0	0	0	4
Pre-requis		Co-requisite					Nil			
Programm	ne N	laster of Science in F	Food	Nutr	ition a	and D	ietetio	es		
Semeste		Fall/ III Semester of s								
Course		different aspect of diet								
Objective	2. To study about t	he different nutrient n								
_	3. To learn planning	g and modification of								
CO1		erent aspect of food n								
CO2		ferent aspect of diet n					ations	in dis	eases st	ate
CO3		ge on planning of diffe								
CO4		ice of therapeutic diet					6	1	-411	
CO5	Evaluate the signifi	cance in the modificat			et in d	inere	nt reed	nng m	etnoas.	l
Unit-No.	Conte	nt	Con Ho		I	Learn	ing O	utcom	ie	KL
	Introduction to clinica	l therany-	110	uı						
I	Introduction, Role of die		5	:	Role	of diet	ician			1,2
	care. Patient Care and C		٠		Ttore v	or area	ician			1,2
	Adaptation of therapeu	-								
	Introduction to therapeu									
	dietary adaptation for th	• •								
	Normal nutrition- a base	-								
	diet, Diet prescription a	•								
II	therapeutic diets		1	0	Learning of hospital diet,					1,2
	<b>Routine Hospital Diets</b>	s: Normal or			different, mode of feeding				ing	
	general diets, Liquid die	ets, soft diets.								
	Mode of Feeding: Oral	O.								
	enteral feeding, Periphe	ral vein feeding,								
	Total parenteral nutritio									
	Nutritional manageme	ent in infections								
	and fever:									
III	Typhoid, Pneumonia an		10	Different types of diet for infections, weight manage					1,2	
	Nutritional care in wei		infe			ions, v	veight	mana	gement	,-
	Introduction, underweight	ht, overweight and								
	obesity, PCOS.									
	Nutrional management	t in cardiovascular								
	<b>diseases:</b> Dyslipidemia, Atheroscl	larocic								
	Hypertension, Myocardi				Diot n	adifi	notion	s for C	WD	
IV	Angina Pectoris, Chroni		10	0	Diabe		auon	5 101 C	νD,	1,2
	Rheumatic heart disease				Diaoc	ics.				
	Nutrional managemen									
	mellitus and gout	a in diabetes								
	Nutritional manageme	ent in gastro								
	intestinal diseases: Dia	_								
	Constipation, Gastritis,	•			TCV.	-				
V	bladder and biliary disor	_	10	0	Thera	_				
	Malabsorption Syndro	_			gastro	ıntestı	nai di	seases		
	Steatorrhoea, Lactose In									
Page   <b>50</b>		Curriculum and Syl	llabus	- 2024 -	25, M. S	: in Food	l, Nutriti	on and I	Dietetics, Fo	S, AdtU

				l
	spruce, Crohns disease, Irritable bowel			
	disease.			
	1. Planning, preparations and calculations			
	of nutritive value of:			
	Routine hospital diet: Liquid diet: Clear			
	liquid, Full fluid, Semisolid diet, Soft diet			
	2. Planning, preparations and calculations			
	of nutritive value of:			
	Feeds: Nasogastric (NG) feeds and			
	Jejunostomy (JJ) feed			
	3. Planning, preparations and calculations			
	of nutritive value of:			
	Cardiovascular diseases: Hyperlipidemia			
	and Hypertension			
	4. Planning, preparations and calculations		Learn different types of	
	of nutritive value of:		hospital diet, Feeding method,	
VI	Gastrointestinal tract: Diarrhoea and		diet for CVD, Gastrointestinal	1.0
(Practical)	Constipation	16	disorder, peptic ulcer, Celiac	1,2
	5. Planning, preparations and calculations	16	disease and Crohn's disease,	
	of nutritive value of:		diabetes mellitus, gout	
	Gastrointestinal tract: Peptic ulcer and			
	gastritis			
	6. Planning, preparations and calculations			
	of nutritive value of:			
	Gastrointestinal tract: Celiac disease and			
	Crohn's disease			
	7. Planning, preparations and calculations			
	of nutritive value of:			
	Gastrointestinal tract: Diabetes mellitus			
	8. Planning, preparations and calculations			
	of nutritive value of:			
	Gastrointestinal tract: Gout			

T1: Joshi, S. A., Nutrition and Dietetics, Tata McGraw Hill Publications, New Delhi, 2004.

T2: Srilakshmi B., Dietetics, New Age International (P) limited Publications, 2004

#### **REFERENCE BOOKS:**

R1: Raymond, J. L., & Morrow, K. (2020). Krause and Mahan's food and the nutrition care. Elsevier Health Science

R2: Antıa F.P., & P. Abraham. (2002) Clinical Dietetics and Nutrition.

R3: Shils, M. E., Olson, J. A., Shike, M. and Ross, A. C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins

R4: Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkins.

R5: Garrow, J. S., James, W.P.T.

## OTHER LEARNING RESOURCES:

Courseera, swayam

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Understand the different aspect of food nutrients and its affect in health and wellbeing	1,2				
2	Learn and apply different aspect of diet modification and adaptations in diseases state	1,2				
3	Acquired knowledge on planning of different hospital diet	1,2				
4	Apply the importance of therapeutic diet in diseases condition	1,2				
5	Evaluate the significance in the modifications of diet in different feeding methods.	1,2				

SEMESTER – III											
Course Title APPLIED NUTRITION I											
Course co	de 24MSFD2105R	Total credits: 4	L	T	P	S	R	O/F	C		
		Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requis		Co-requisite					Nil				
Programme Master of Science in Food Nutrition and Dietetics											
Semeste		all/ III Semester of seco					ram				
Course	_	ferent aspect of Food Sci		•		_					
Objective	29	2. To study about the application of principles of food science in product development.									
		techniques of food adultra				mmo du	otion	and nac	Ironina		
CO1	Understand the diffe	erent application of food s	cien	ce III	1000	produ	CHOIL	and pac	Kaging		
CO2	Give them a clear pitechnology.	cture of recent trends and	l adv	ancen	nent i	n foo	d scie	nce and			
CO3		standard and regulations	gov	erned	hy Ir	dian	govt				
CO4	Develop nutrients de		govi	cificu	оу п	luiaii	govi				
CO5	_	chniques and skill for det	ectin	g foo	d adu	lterati	on				
		-		ntact							
Unit-No.	Con	tent		our	Le	arnin	g Out	come	KL		
	Role of macronutrient	s: Role of fiber in lipid									
	metabolism, colon funct	tion, blood glucose									
I	level and G.I tract funct	evel and G.I tract functions – Disadvantages of Role of						le of dietician			
1	Dietary fiber, Role of sa	turated fat, cholesterol,	,	Note of dictician					1,2,3		
	lipoprotein and Triglyce	erides and EFA in the									
	diet										
	Standards for foods: Milk and milk products, Fruits and vegetables, Beverages and Fleshy				Learning of hospital						
II				10	diet, different, mode				1,2		
	foods.				of feeding						
	Food regulations-Stand	<del>-</del>									
	<b>control</b> : Principles of o										
	material process Control and product ins			Dif	ferent	types	of				
III	Food laws and consum		1	10	diet for infections,				1,2		
	Consumer protection, C				wei						
	Legal modes of protecti										
	redressal of consumer g	-									
	<b>Product development:</b>										
	product-types and drawing										
***	product development, st	_		10	Die	t mod	ificatio	ons for	1.2.4		
IV	development, Success in	•	]	10	CV	D, Dia	abetes		1,2,4		
	Consumer research, Rol	e of sensory evaluation									
	in consumer product acc	in consumer product acceptance.									
	Food adulteration and	hygiene: Definition,			The	ranou	tic die	at for			
${f v}$	Common adulterants in	1	10		_	estinal		1,2,3,4			
•	Methods of detecting ad	lulterated foods, Food	10		_	eases	ounal		1,2,3,7		
	Sensitivity										
	1. Introduction to different					owled					
VI	food processing industri						equip				
(Practical)	2. Evaluation of proxima	ate composition-	1	16			analy		1,2,3,4		
	moisture			-				imate			
	3. Evaluation of proxima	ate composition- protein			con						

4. Evaluation of proximate compo	sition- total evaluation, Storage
ash	studies by packaging
5. Evaluation of proximate compo	sition-fats materials
6. Evaluation of proximate compo	sition-Fiber
7. Introduction to sensory analysis	and uses of
sensory tests: Establishing sensory	panels,
Recognition tests for 4 basic tastes	s, odour and
aroma., Analytical tests: (i) Different	ence,
(ii) Ranking, (iii) Descriptive, (iv)	Scoring and
(v) Rating	
8. Standardization and storage stud	lies of
developed food products and using	g different
packaging properties.	

T1: Norman N. Potter and Joseph H. Hotchkiss, Food Science, CBS publishers and distributors, Fifth edition, 2000

#### **REFERENCE BOOKS:**

R1: Manay, S. and Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004

R2: B. Srilakshmi, Food science, New Age Publishers, 2002

#### **OTHER LEARNING RESOURCES:**

Courseera, swayam

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the different application of food science in food production and packaging .	1,2					
2	Give them a clear picture of recent trends and advancement in food science and technology.	1,2					
3	Learn different food standard and regulations governed by Indian govt	1,2					
4	Develop nutrients dense food products	1,2					
5	Analyze different techniques and skill for detecting food adulteration.	1,2					

SEMESTER – III											
Course Tit	Course Title CLINICAL NUTRITION II  Total anality 4 I T D S D O/F C										
Course cod	le 24MSFD2108R	Total credits:	4	L	T	P	S	R	O/F	С	
Course coe		Total hours: 45T	+30P	3 0 2 0					0	4	
Pre-requisi		Co-requisite					Nil				
Programme Master of Science in Food Nutrition and Dietetics											
Semester Fall/ III Semester of second year of the program											
Course Objective	<ul><li>1. To review about the different biochemical metabolism reaction of the body.</li><li>2. To understand how this metabolism takes place in correlation with the nutrients of the food</li><li>3. To plan meal for different conditions.</li></ul>										
CO1	Understand the differe	ent aspect of food nut	rients a	nd in	iteraci	ions.					
CO2	Understand and apply and systemic diseases	-	iet mod	ificat	tion a	nd ada	aptatio	ons in	metabo	olic	
CO3	Analyse and understar	nd different diet for in	nborn e	rror i	netab	olism					
CO4	Acquired knowledge of										
CO5	Apply therapeutic diet										
Unit-No.	Conter		Conta	ct			ng Oı	ıtcom	e	KL	
			Hou	r							
I	Nutrient and drug inter Nutrition on Drug, Drug Nutritional Status, Drug a Interaction	Effects on	5	Learn the importance of Nutrient and drug interact						1,2	
II	_ 10					Learn different types of diet for AIDS 1,2					
Ш	disorders: Viral Hepatiti Hepatic encephalopathy of Nutritional management	Nutritional management in hepatic disorders: Viral Hepatitis, Liver Cirrhosis, Hepatic encephalopathy or Hepatic coma Nutritional management in pulmonary disorders: Asthma, COPD, Bronchitis, Pneumonia			Learn different types of diet modification for liver and pulmonary diseases.					1,2	
IV	Nutritional management diseases: Acute and Chron Nephrotic Syndrome, Renal Transplantation	onic renal diseases,	10	1	Learn different types of die modification for renal diseases				diet	1,2	
V	Nutritional management in neurological and mental disorders: Eating disorders, Alzheimer's disease, Parkinson's disease, Nutritional and holistic care for neurological and mental disorder.  Inborn Errors of Metabolism  Learn different Types of diet modificatio neurological disorders					on for	1,2				
VI (Practical)	1. Planning, preparation a nutritive value of hepatic Hepatitis, Liver Cirrhosis 2. Planning, preparation a nutritive value of hepatic encephalopathy or hepati 3. Planning, preparation a nutritive value of pulmon Asthma, COPD, Bronchi	disorders: Viral and calculation of disorders: Hepatic c coma and calculation of hary disorders:	Learn diet modification liver disorders, Learn d modifications of Nephrodisorder						et	1,2	

4. Planning, preparation and calculation of	
nutritive value of renal disorders: Nephrotic	
syndrome, Dialysis	
5. Planning, preparation and calculation of	
nutritive value of renal disorders: Renal	
calculi and Renal Transplantation	
6. Planning, preparation and calculation of	
nutritive value of cancer	
7. Planning, preparation and calculation of	
nutritive value of AIDS	
8. Planning, preparation and calculation of	
nutritive value of anemia, burns	

T1: Srilakshmi. B., Dietetics, New Age International (P) Ltd, Publishers, 2014

T2: Mahan, L.K. and Escott-Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.

#### **REFERENCE BOOKS:**

R1: Srilakshmi. B., Dietetics, New Age International (P)Ltd, Publishers, 2014

R2: Robinson C. H., Lawer M. R., Chenowelth.WIC., and Garwich A. E., Normal and therapeutic nutrition, McMillan Publishers Co., New York, XVII Edition, 1986.

R3: Mahan, L.K. and Escott-Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.

R4: Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care,  $4^{th}$  Edition, Williams and Wilkins

R5: Raymond, J.L., & Morrow, K. (2020). Krause and mahan's food and the nutrition care. Elsevier Health Science

R6: Antıa F.P., & P. Abraham. (2002) Clinical Dietetics and Nutrition.

#### **OTHER LEARNING RESOURCES:**

Courseera, swayam

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the different aspect of food nutrients and interactions.	1,2,3					
2	Understand and apply different aspect of diet modification and adaptations in metabolic and systemic diseases state	1,2,3					
3	Analyse and understand different diet for inborn error metabolism	1,2,3					
4	Acquired knowledge on the planning diet for different conditions	1,2,3					
5	Apply therapeutic diet for extreme nutrient required patients.	1,2,3					

	SEMESTER :	– III							
Course Tit			RITI	ON II					
	Total credits:	Total credits: 4 L T P S						O/F	С
Course cod	le 24MSFD2107R Total hours: 45T	+30P	3	0	2	0	0	0	4
Pre-requisi	te Nil Co-requisite	;			I	Nil	1	I.	II.
Programm			utri	tion a	nd Di	etetics			
Semester	-								
1 To study a different aspect of food standards and safety									
Course	2. To study the different regulatory bodies	s of foo	od sa	fety ar	nd pro	ductio	n.		
Objectives	3. To study the advanced methods of food	process	sing						
CO1	Understand the different applications of f	ood sci	ienc	e in fo	od pro	ductio	n and	d pack	aging.
CO2	Give them a clear picture of regulatory be	odies of	f foo	od scie	nce ar	d tech	nolog	gy.	
CO3	Understand the recent trends of health for	ods.							
CO4	Acquired knowledge on different packag	ing mat	teria	1.					
CO5	Evaluate the significance of recent food t	rends							
Unit-No.	Content	Cont	act	T a	ornin	g Out	com	<b>a</b>	KL
UIIIt-No.	Content	Hou	ır	Le	arıııı	ig Oui	COIII	e	KL
	<b>Introduction:</b> Aim and Objectives of Food								
	Science and Technology Constituents of								
	Food: Chemical, Physical and Nutritional								
I	Alterations Occurring in Foods During	5		Learn different Constituents of foods			1,2		
_	Processing and Storage						-,-		
	Enzymes of importance in food								
	<b>processing:</b> Carbohydrates, Proteases,								
	lipases, Oxidoreductases, Hydrolases.								
	Introduction to advanced technologies								
	used in food processing: Agglomeration,								
	agitation, air classification, Membrane								
	technology (reverse osmosis and ultra								
-	Filtration), high pressure, surface heat	10		Learn technologies used in				d in	1.0
II	exchanger, ohmic resistance heating, super	10	,	food proce		_			1,2
	critical extraction.								
	<b>Pre and Primary Processing:</b> Some Basic								
	Concepts  Formantation Comi Processed Foods								
	Fermentation, Semi Processed Foods, Instant Foods								
	Quality Evaluation of Food: Requirement								
	for conducting sensory tests, Types of tests,			Learn	differ	ent ty	nes o	f	
III	limitation of sensory evaluation. Objective	10	)			uation			1,2,4
	methods of evaluation of food.			quant	y crai	uunon	01 10		
	Food Trends: Changing food trends and								
	consumer behavior in, Purchasing foods,			_		_			
IV	Lifestyle changes: economic, socio-	10	)			rent Fo	ood		1,4,5
	cultural, Psychological influences and			Trend	ls				, ,-
	marketing influences.								
	Food Packaging: Food packaging-								
	Principles in the development of safe and								
₹7	protective packing,	4.0		Learn	diffe	ent ty	pes o	f	1,2,3,
V	Packaging materials (metals, glass, paper	10	'	Learn different types of food packaging			_		4
	and plastics) use of packaging in extending								
	shelf life of unprocessed foods (modified								
<u> </u>		1		1					

	<b>Food Safety:</b> Food Toxins, Food Standards			
	rood Salety. Food Toxins, Food Standards			
VI (Practical) 5	1. Introduction to different equipment in processing and preservation 2. Preservation by heat treatment:    Sterilization, 3. Preservation by heat treatment:    Blanching 4. Preservation by cold treatment:    Refrigeration 5. Preservation by cold treatment:    Freezer, deep freezing 6. Different methods of drying:    Mechanical drying 7. Different methods of drying: Sun drying 8. Preparation of extruded products	16	Learning the equipment of processing and preservation, Techniques of heat treatment, Techniques of cold treatment, Techniques of dry treatment, Techniques of extruded products	1,2,3,

- T1: Norman N. Potter and Joseph H. Hotchkiss (1999) Food Science, Springer
- T2: G. Subbulakshmi and Shobha U Udipi (2006) Food Processing and Preservation. New age publishers; First edition (1 January 2006)

#### **REFERENCE BOOKS:**

- R1: Norman N. Potter and Joseph H. Hotchkiss (1999) Food Science, Springer
- R2: Fields, M. L. (1979). Fundamentals of food microbiology. AVI Publishing Co.Inc.
- R3: Matthews, K.R., Kniel, K.E., & Montville, T.J. (2017). *Food microbiology: an introduction*. John Wiley & Sons.

#### **OTHER LEARNING RESOURCES:**

Courseera, swayam

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Understand the different applications of food science in food production and packaging.	1,2					
2	Give them a clear picture of regulatory bodies of food science and technology.	1,2					
3	Understand the recent trends of health foods.	1,2					
4	Acquired knowledge on different packaging material.	1,2					
5	Evaluate the significance of recent food trends	1,2					

			SEMESTER – III							
Course T	itle	CORPORATE	COMPETENCY (Commu	nicat	ive I	Engli	sh &	Soft	Skills)	
Course co	ode	24UMPD2101R	Total credits: 2	L	T	P	S	R	O/F	C
			Total hours: 60P	0	0	4	0	0	0	2
Pre-requi		Nil	Co-requisite	•4•	-	I D' 4	Ni	l		
Program			ter of Science in Food Nut							
Semeste	er		III Semester of second yea with the various tools of an							
		•	ting skill instruct, influence,			•			ace the	
Course	<b>.</b>	listeners.	ing skin instruct, influence,	Ciigag	50, 0	aucat	c, or a	тррсс	ase the	
Objectiv			ncy, presentability and quality	tv of 1	esur	ne an	d pro	vide	guidanc	e for
		_	self-evaluation in social med	-			r		<i>6</i>	
		•	the students for the campus		s & v	walki	ng int	tervie	ews.	
CO1		It will prepare the lear	ners to speak with greater co	ntrol	and	charis	sma ii	n fro	nt of oth	ers.
CO2		It will have a positive	impact in their thought proce	ess an	d pro	oblen	ı-solv	ing s	skills.	
CO3			s with all the necessary tools						professio	onal
COS			n to highlight and assess the							
CO4		•	echniques to solve critical p						-	
			rviews, improve their comm							
CO5		It will prepare the lear	ners to speak with greater co	ntrol	and	charis	sma ii	n fro	nt of oth	ers.
Unit-No.	3.7		Content							
		lule 1-Presentation Sk	IIIS							
I		Introduction Essential characteristics	of a good presentation							
		Preparation of a good p	• 1							
		lule 2-Public Skills	resentation							
		Fear of Public Speaking	r.							
			rcoming Fear of Public Spea	aking,						
		Confidence and Control,								
II	iv.	Physiology and Stress - Control/Process,								
11	v. '	Tips for Presentations and Public Speaking,								
	vi.	Tips for Using Visual A	aids in Presentations,							
			nd Creating Presentations,							
		Delivering Presentations	*							
		abt Clearing and Summary of Main Points								
			n on Resume, Curriculum	Vitae	e, W	riting	g cove	er let	ter &	
		kedIn Profile	& samaaning of Daguma							
III		-	a & screening of Resume.  Ver letter screening session							
		Creating a profile on Li	_							
		w to utilize it	iikcuiii							
		dule 4-Leadership & N	Management Skills							
		Concepts of Leadership	=							
		Leadership Styles,	•							
IV		Manager VS Leader,								
	iv.	How to be an Effective	Leader,							
	<b>v.</b>	Mock/Practice Session,								
	vi.	Doubt Clearing Session								

	Module 5-Research Paper-Writing Skills						
V	i. How to write a research paper						
	Key point in Research Work						
	Module 6- Interview Skills & Dress code Ethics						
	i. Types of the interview-telephonic, virtual & face to face						
	ii. Online interview, personal interview,						
	iii. Panel interview,						
	iv. Group interview,						
	v. JAM session,						
	vi. Types of interview questions-traditional/common interview questions,						
	vii. Case interview questions,						
VI	viii. General Strategies for answering questions,						
(Practical)	ix. Marketing your skills and experiences,						
(Fractical)	x. Preparation before the interview,						
	xi. How to dress up for an interview,						
	xii. How to maintain eye contact and positive body language,						
	xiii. How to be presentable,						
	xiv. Interview dos and don'ts,						
	xv. Introduction to Dress Code Ethics,						
	xvi. Purpose and Importance						
	xvii.How to Make 'FIRST IMPRESSION'						
	What to Wear During Interviews or Any Other Formal Meetings-Male & Female						
	Module 7- Mock Interview						
	i. Practical Mock Interview,						
VII	ii. Feedback-Receiving Feedback,						
V 11	iii. Giving Feedback,						
	iv. Advantages of Effective Feedback,						
	v. How to deal with negative feedback.						

T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

T2: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition)

#### **REFERENCE BOOKS:**

R1: Garg. Manoj Kr. (2018) English Communication: Theory and Practice

#### OTHER LEARNING RESOURCES:

 $\frac{https://brightlinkprep.com/10-best-toefl-prep-books/}{https://files.eric.ed.gov/fulltext/EJ1132742.pdf}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	It will have a positive impact in their thought process and problem- solving skills.	5					
2	It will arm the students with all the necessary tools and skill sets to prepare professional resume. They will learn to highlight and assess themselves in social media.	2					
3	It will impart in them techniques to solve critical problems in an interview, develop strategies to crack interviews, improve their communication skills, boost their confidence	5					
4	It will prepare the learners to speak with greater control and charisma in front of others.	5					
5	It will have a positive impact in their thought process and problem- solving skills.	5,6,8					

			SEMESTER – III									
Course 7	Γitle		ADVANCE NU	JTRI	ITI	ON						
Course	ahor	24MSFD2101R	Total credits: 2		L	T	P	S	R	O/F	C	
Course	tout	24MSFD2101K	Total hours: 30T		2	0	0	0	0	0	2	
Pre-requ		Nil	Co-requisite					N				
Progran			Master of Science in Food									
Semest	ter		Fall/ III Semester of secon									
		*	fferent concepts of advance	nutr	itio	n an	d nutr	itiona	ıl			
Cours		requirement in sp										
Objecti	ves	•		t modifications and their applications.								
904			role of different nutraceutic									
CO1	-		cacy and importance of fun									
CO2		* *	oly nutritional knowledge in	ı vari	ous	aspe	ects li	ke sp	orts ni	utrition,	space	
001			ge, emergency care etc.	•,•								
CO3			ge on recent advances in nut						1.1	•		
CO4		interactions in hum	owledge on and metabolic	role o	Of V	arıou	s nuti	nents	and th	neir		
COF				-4	. 1 41		1:	-41	_			
CO5 Unit-		Anaryze the pharms	acological actions of nutrier	Cor			трпс	anon	S.			
No.		Co	ntent		our		Lear	rning	Outo	come	KL	
110.	Con	cent of advanced n	utrition: Application of	110	oui							
			pe and Limitation of				Learn the concept of Nutrition and its					
I		d, Nutrition and Diet	_		5	N					1,2	
		ancements in nutrition				p	rincip	oles				
			ns and uses in processed									
		products. Chemical	-									
		cological aspects.	,									
		d fortification and Food enrichment:										
***	Obje	ectives, principles an	d nutritional aspects.	10		A	cquir	ed kn	owled	dge of	1.0	
II	_		enomics: specific food	J	10		ood a			C	1,2	
	mod	lulating nutrigenon	nics (lycopene, omega3)									
	Nut	ritional requiremen	ts for special conditions:									
	Spec	cial nutritional needs	for space, military,									
	eme	rgency care and sea	voyage.									
		<b>nuno-nutrition:</b> Cor	•			Δ	Canir	ed kr	owled	dge of		
III	_	_	erent immune-nutrients	1	10		_		trients	-	1,2	
			t physiological conditions.							,		
			tion and types, Efficacy									
			resistant fibre, Probiotics,									
		•	c, Antioxidant and Pro-			Acquired knowledge of						
TX7		dant Aspects.	4 66 1		10	Acquired knowledge of Functional and bioactive			1.0			
IV			ve components of foods:		10						1,2	
		•	ources, bioavailability and			C	ompo	nents	of fo	ous		
			cations for: polyphenols, ycopenes, carotenoids),									
		no-sulphur compour										
			its for special conditions:			<u> </u>	Conir	ed br	owlea	dge of		
v		ial nutrition needs for	<del>-</del>	1	10		_			ements	1,2	
•	_	rgency care, sea voy	-	'	_ 0				onditi		1,2	
	21110	-50110, but of	~~·			1,	or spe	Jiui C	JIMIU	V110	1	

T1: Sareen S Gropper, Advanced Nutrition and Human Metabolism, 1990

T2: Goldberg, Functional Foods: Designer foods, Pharma foods, Nutraceuticals, Chapman & Hall, New York, 1994

#### **REFERENCE BOOKS:**

R1: Norman N. Potter and Joseph H. Hotchkiss (1999) Food Science, Springer

R1: Raffaele Caterina, Al Sareen S Gropper, Advanced Nutrition and Human Metabolism, 1990

R2: Goldberg, Functional Foods: Designer foods, pharma foods, Nutraceuticals, Chapman & Hall, New York, 1994 fredo Martinez, Martin Kohlmeier, Principles of Nutrigenetics and Nutrigenomics, 2019, Elsevier

#### **OTHER LEARNING RESOURCES:**

Courseera, swayam

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand the efficacy and importance of functional and bioactive components.	1,2
2	Understand and apply nutritional knowledge in various aspects like sports nutrition, space nutrition, sea voyage, emergency care etc.	1,2
3	Acquired knowledge on recent advances in nutrition.	1,2
4	Deliver in depth knowledge on and metabolic role of various nutrients and their interactions in human nutrition.	1,2
5	Analyze the pharmacological actions of nutrients and their implications.	1,2

			SEMESTER – III							
Course	Course Title PRODUCT DEVELOPMENT AND MARKETING  Total credits: 1 L T P S R O/F C									
Course	anda	24MSFD2102R	Total credits: 1	L						
Course	coue	24WIST D2102K	Total hours: 30P	0	0	0 2 0 0 0				
Pre-req	uisite	Nil	Co-requisite				Nil			
Program			<b>Laster of Science in Food</b>							
Semes	ter	F	Fall/ III Semester of secon	d yea	r of t	ne pro	gram			
Cour	200	1.To understand the	steps in food product devel	opme	nt.					
Object		2.To know about the	e concept of entrepreneursh	ip.						
Object	1103	3.To study about ro	le and responsibilities of en	trepr	eneur.					
CO		Explain the concept								
CO2			eneurship motivation							
CO		Explore world of entrepreneurs								
CO ₂		•	between successful and fail		•					
COS	5	Understand the valu	es and attitudes of successf	_		neurs				
Unit- No.		Cor	ntent		ntact Iour	Lea	arning	g Outo	ome	KL
I	selec	duction on developin tion of target group. Paration of questionnai	₹	d	2		rn to d		•	3,5
II		dardization of recipe, ory evaluation.	Preparation method,		2	_	mulate stionn			1,2
III	trans	portation and distribu			2	met	ndardiz hod & kaging	Diffe		1,2,3
IV	prod	_	ution of the developed developed product		2	Skill of marketing 1,4				
V	Repo	ort writing and Presen	tation.		2	Doc	ument	tation		1,5

T1: Manimala, M. J. Entrepreneurship Theory at the Crossroads: Paradigms and Praxis, 2005

#### **REFERENCE BOOKS:**

R1: Earle M. and Earle, R. 2007. Case studies in food product development. Woodhead Publishing Ltd., Abington, Cambridge, UK.

R2: Frewer, Land Trijp, H. 2007. Understanding consumers of food products. Woodhead Publishing Ltd., Abington, Cambridge, UK.

#### OTHER LEARNING RESOURCES:

Courseera, swayam

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the concept of entrepreneurship	5,7,8
2	Learn about entrepreneurship motivation	5,7,8
3	Explore world of entrepreneurs	5,7,8
4	Analyze difference between successful and failed entrepreneurs	5,7,8
5	Understand the values and attitudes of successful entrepreneurs	5,7,8

			SEMESTER – III							
Course	Title		RESEARCH	I ET	HICS	5				
Course	Code	24UMRE2101R	Total Credits: 1	L	T	P	S	R	O/F	C
Course	Couc	240WIKE210IK	Total Hours: 15T	1	0	0	0	0	0	1
Pre-Req		NA	Co-Requisite				N			
Progran			laster of Science in Food							
Semes	ter		all/ III Semester of seco							
Cour Object	ives	emphasize the n practices.  2. To address issue importance of av plagiarism.  3. To develop criticomplex research norms.	e of integrity in data collected of honesty, transparent erelated to authorship, purvoiding research miscond cal thinking and ethical discensives, balancing science.	blica uct li ecisi	ind acceptant and acceptant acceptan	thics, ta fabraking gress	peer notication	in restriction in review on, fals	search	ne n and
CO1			y research ethics theories							
CO2		-	thics issues such as respo					misco	nduct.	
CO3			ts and results in ethical re							
CO4		• • • • • • • • • • • • • • • • • • • •	procedures for sampling,				and r	eporti	ng.	
CO5	) 	Apply ethical princ	ciples to research design a		valua	tion				
Unit no.	ETH	ICC. Introduction to	Content		intro	dustis	n to n	20001	haami	
			o the course and each other philosophy, nature of more						•	roh
I		-	on; research ethics. Hone	-	-					
_	_	_	ardship; conflicts of interest	-			_		_	-
		_	h and researchers in socie							
			CT- Ethics with respect to		nce ar	nd res	earch.	Intel	ectual	
***			grity. Scientific miscondu							
II	Plagia	arism (FFP). Redund	dant publications: duplica	te an	d ove	rlappi	ng pu	blicati	ions, sal	ami
	slicing	g. Selective reportin	g and misrepresentation of	of da	ta					
	PUBI	LICATION ETHIC	CS- Publication ethics: de	finiti	on, in	trodu	ction a	and in	portanc	e.
	_		setting initiatives and gu							
III			isconduct: definition, con	_	_					
			types. Violation of publi					_		outor
	_	-	olication misconduct, com	ıplaiı	nts and	d appe	eals. P	redate	ory	
	•	thers and journals.	CHING O	. 1'	• -	1				
			SHING-Open access put						1	•
137			resource to check publish						<b>U</b> 1	ies.
IV			predatory publications de viz. JANE, Elsevier Journ	_						or
	etc.	ii suggestion tools v	iz. JAINE, Liseviel Journ	ai i'ii	iluci, i	3pring	ger Joi	uman	ouggesu	51,
		ICATION MISC	ONDUCT Group Discuss	ions	· Subi	ect sn	ecific	ethics	al iccues	
			s of interest. Complaints			•				
		-	re tools; Use of plagiarism				_			
₹7		open source softwar						-		
V		-	SEARCH METRICS-D	atab	ases: I	ndexi	ng da	tabase	s. Citati	ion
	databa	ases: Web of Science	e, Scopus, etc. Research	Metr	ics: In	npact	Facto	r of jo	urnal as	per
	Journa	al Citation Report, S	SNIP, SJR, IPP, Cite Scor	e. M	etrics	h-inc	lex, g	index	, I 10 in	dex,
	altmet	trics.								

T1: Bird, A (2006). Philosophy of Science. Routledge.

T2: MacIntyre, Alasdair (1967) A Short History of Ethics. London.

T3: Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019)

#### **REFERENCE BOOKS:**

R1: On Being a Scientist: A Guide of Responsible Conduct in Research: National Academy of Science, National Academy of Engineering and Institute of Medicine Third Edition, National academics Press. (2009).

R3: George R, (2011). Sociological Theory, Rawat Publication, New Delhi, India.

R3: George R, (2019). Post Modern Social Theory, Rawat Publication, New Delhi, India.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe and apply research ethics theories and methods.	6
2	Explain research ethics issues such as responsibility, vetting, and misconduct.	6
3	Illustrate arguments and results in ethical research inquiries.	5, 6
4	Identify and apply procedures for sampling, data collection, and reporting.	2, 3, 4
5	Apply ethical principles to research design and evaluation	4

	SEMESTER – III									
Course Title	MINI RESEARCH (REVIEW OF LITERATURE-R3)									
Course code	24MSFD2103R	Total credits: 4	L	T	P	S	R	O/F	C	
Course code	24MSFD2103K	Total Credits. 4	0	0	6	4	0	0	4	
Pre-requisite	Nil	Co-requisite				Nil				
Programme	N	Master of Science in Foo	d Nutr	ition a	nd Di	etetics	3			
Semester	Fall/ III Semester of second year of the programme									
Course	1. Appreciate and u	nderstand the importance	of vari	ous re	search	writir	ng and	review		
Objectives	2. Applying the tec	hniques and skill for writi	ng abst	tract, s	hort co	ommu	nicatio	ons.		
Objectives	3. To learn technica	l writing and how to revie	w litera	iture.						
CO1	Develop competen	ce in writing and abstract	ing skil	1						
CO2	Learn to write literature and review									
CO3	Develop competence in Project proposal									
CO4	O4 Acquired the knowledge to conduct scientific project									
CO5	Analyze the signifi	cant aspect of scientific p	roject							

	CO PO Mapping	
SN	Course Outcome (CO)	<b>Mapped Program Outcome</b>
1	Develop competence in writing and abstracting skill	3
2	Learn to write literature and review	3
3	Develop competence in Project proposal	3
4	Acquired the knowledge to conduct scientific project	3
5	Analyze the significant aspect of scientific project	3

	SEMESTER – IV								
<b>Course Title</b>		INTERNSHIP							
Course code	24MSFD2201R	Total credits: 6		T	P	S	R	O/F	C
Course code	24WISFD22UIK	Total credits: 0	0	0	0	24	0	0	6
<b>Pre-requisite</b>	Nil	Co-requisite				Ni	il		
Programme	N	<b>Iaster of Science in F</b>	ood N	lutriti	on and	l Diete	etics		
Semester	I	Fall/ IV Semester of se	econd	year	of the	progr	am		
	1. To gain hands or	experience of workin	g in v	arious	institu	tions r	elated	to the area	a of
Course	Food and Nutriti	on.							
Objectives	2. To learn the inter-relationship and intr			onshi	p betw	een the	e emplo	oyee	
	3. To understand m	anagement in work pla	ce						
CO1	Extend field exper	ience to apply therap	eutic	interv	entio	n strat	egies i	in hospita	ıl/
COI	industry setup								
CO2	Apply therapeutic	knowledge and acqu	ire pr	actica	l skill	s in the	e field	of exper	tise
CO3	Evaluate and mana	age hospitalized pation	ents w	vith nu	utritio	n inter	ventio	n strategi	ies
CO4	Analyze thoughtful assessments and plans for evaluation and management in the							the	
CO4	work environment								
CO5	Identify the scope	of exposure and emp	loyme	ent op	portur	nities i	n relev	vant field.	

#### Hospital internship will be continued in the downtown hospital for 60 days.

- 1. Front page: Name of University, University Logo, Name of the Student, Class, Department
- 2. Certificate
- 3. Acknowledgement
- 4. Contents
- 5. Introduction
- 6. Activities

#### A. Activity I: Internship details

- Name of the Institution where the internship was undertaken
- Dietitian incharge under whose Supervision Internship undertaken (Name and Designation)
- Duration and date of internship
- Dietetic department profile and organization
- Posting schedule of the intern

Day/week	Posting	Activities schedule and undertaken

- Kitchen layout
- Food procurement and storage
- Schedule/timing for meal distribution
- Dietetic department menu

#### B. Activity II: Modified therapeutic diets and special feeding methods

#### C. Activity III: Clinical posting and nutritional care of patients

i. Ward posting detail

Major disease conditions observed and Medical Nutrition Therapy recommended during ward posting

Sl. No	Ward Posting	Major disease conditions observed	Recommended diets

- ii. Nutrition and diet counselling
- List of educational material available
- Nutrition and diet counselling for both In and Out patients

Counselling details	IPD/OPD Posting	Date/Time

Note: Separate table for IPD and OPD

#### D. Activity IV: Case studies

#### -Disease case

Case problem (indicate the disease condition)

#### -Patient profile

Patient name

Age

Weight (kg)

Food habits Occupation

Educational qualification lifestyle

Date of admission

Date of discharge

Duration of stay

Medical diagnosis

Past history

#### Medical history of the case

- Present problem
- Physical parameters examination
- Biochemical parameters

Parameters	At the time of	At the time of discharge	Normal values during the
analyzed	admission		treatment

#### Management and treatment details

- i. Drug therapy (give the name of the drug/injections etc given/prescribed)
- ii. Blood glucose monitoring (record in tabular form and follow-up the patient's blood glucose level if analyzed before breakfast, before lunch and/or before dinner the period of hospitalization). (note: only for diabetes mellitus)
- iii. Dietary management of the disease condition
- iv. Nutrition/diet counselling
- v. Care prognosis:(comment on the portable course and outcome with respect to patient's condition/after the disease treatment in the hospital)

vi. Case study outcome: (brief highlights how the case study helped in your understanding of the dietary management of the disease condition under study)

#### E. Activity V: Presentation

**7. Annexure/Appendices:** Abbreviations, Biochemical Parameters, Portion Size, Diet Sheets etc

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Extend field experience to apply therapeutic intervention strategies in hospital/industry setup	1,2,5,7						
2	Apply therapeutic knowledge and acquire practical skills in the field of expertise	1,2,5,7						
3	Evaluate and manage hospitalized patients with nutrition intervention strategies	1,2,5,7						
4	Analyze thoughtful assessments and plans for evaluation and management in the work environment	1,2,5,7						
5	Identify the scope of exposure and employment opportunities in the relevant field	1,2,5,7						

	SEMESTER – IV								
<b>Course Title</b>	RES	EARCH/ DATA ANA	LYS	IS/ DO	OCUM	ENTA	ATION	N .	
Course code	24MSFD2202R	Total credits: 12		T	P	S	R	O/F	С
	24MSFD2202R	Total Credits. 12	0	0	20	4	6	0	12
<b>Pre-requisite</b>	te Nil Co-requisite Nil								
Programme	Programme Master of Science in Food Nutrition and Dietetics								
Semester	Fall/ IV Semester of second year of the program								
	1. Appreciate and understand the importance of importance of various research writing								
Course	and review								
Objectives	2. Learning to write Abstract and short communication								
	3. To learn techniques of research, tabulation and documentation of research work								
CO1	Develop competence in writing and abstracting skill								
CO2	Learn to write litera	ture and review							
CO3	Develop competenc	e in Project proposal							
CO4	Acquired the knowl	edge to conduct scienti	fic pr	oject					
CO5	Analyze the signific	ant aspect of scientific	proje	ct					
Unit-No.		Co	onten	t					
	Introduction								
	Review of literature								
	Materials and metho	ods							
I	Results and Discuss	ion							
	Summary								
	Annexure/Appendic	es							
	Presentation of the 1	research work							

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Develop competence in writing and abstracting skill	3					
2	Learn to write literature and review	3					
3	Develop competence in Project proposal	3					
4	Acquired the knowledge to conduct scientific project	3					
5	Analyze the significant aspect of scientific project	3					



### ASSAM DOWN TOWN UNIVERSITY

# Curriculum and Syllabus

# Master of Science in Biotechnology

## OUTCOME BASED EDUCATION FRAMEWORK

**CHOICE BASED CREDIT SYSTEM** 

Version: 2.1

# FACULTY OF SCIENCE

July, 2023

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the

programme and to be eligible for the degree. This volume also includes the prescribed literature,

study materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Downey

Member Secretary, Academic Council

#### Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

#### Mission

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

#### **Programme Overview**

M Sc. Biotechnology offers a wide range of courses covering various basic and applied areas of life sciences. The student develops an aptitude and scientific temperament to apply the technical skills in various important areas of Biotechnology such as Immunology, Agricultural Biotechnology, Medical Biotechnology, Plant Biotechnology, and Molecular Biology. The course also offers various techno specific skills, universal ethics and elective courses considering overall development and employability scopes in research, industry and teaching sectors. The course duration is for a period of 2 years.

#### I. Specific Features of the Curriculum

- Experiential learning
- Constructivist approach to learn
- Practical and project based learning

#### II. Eligibility Criteria:

BSc in any area of life sciences with minimum of 45% marks or equivalent CGPA.

#### **III.** Program Educational Objectives (PEOs):

- **PEO-1:** Students will demonstrate expertise in the field of modern biotechnology through a dynamic, research-focused curriculum tailored to meet the demands of both academic and industrial settings.
- **PEO-2:** Students will expand their career prospects in industries and laboratory environments, globally through hands-on experiences in cutting-edge laboratories and dissertation projects that encourage the development of global competencies.
- **PEO-3:** Students will equipped with leadership qualities that enable them to safeguarding the product of their intellect, staying updated on emerging trends and adapting to industry demands required by national and international organizations.

#### **IV.** Program Specific Outcomes (PSOs):

- **PSO1: Interdisciplinary Knowledge:** Able to understand the concept of life sciences and apply the knowledge for empowerment to address challenges within the domains of biotechnology enabling employment opportunities in the relevant field.
- **PSO2:Research & Innovation:** Should have the ability to promote a multidisciplinary approach for research exploration and collaboration with professionals across diverse disciplines of life science.
- **PSO3: Entrepreneurial Ability Development:** Execute innovative ideas within the field of biological research and development by employing scientific methodologies to gain in-depth knowledge, ultimately contributing to entrepreneurial developments.

#### V. Program Outcome (PO):

- **PO1: Biotechnology Knowledge:** Apply comprehensive knowledge of basic sciences, classical and applied life sciences, process technology, computational biology, biostatistics, and analytical techniques in rendering biological interventions to solve biotechnological problems.
- **PO2**: **Problem Analysis:** Identify, formulate, review literature, design and evaluate complex biological problems by applying critical thinking to draw sustainable and strategic solutions.

- **PO3:Solution Design:** Design solutions for complex life science problems and develop systems and processes for holistic socioeconomic development.
- **PO4**: **Investigation and Research:** Conduct research applying comprehensive knowledge and scientific methods, data analyses and interpretation to provide conclusions.
- **PO5:** Communication: Communicate effectively with peers, stakeholders and community, and able to prepare documents, scientific reports and impactful presentations.
- **PO6: Professional Ethics and Values:** Comply with human values, ethics and norms of scientific practice in the profession.
- **PO7:** Environment and Sustainability: Evaluate the impact of formulated biotechnological solutions in socio-economic and environmental contexts, and redesign it for sustainable global development.
- **PO8:** Leadership &Teamwork: Work independently, and as a member/ leader in diverse teams, and in multidisciplinary settings
- **PO9: Lifelong Learning:** Ability to engage in independent and life-long learning in the broadest context of scientific and technological advances.

#### VI. Total Credits to be Earned: 89

VII. Career Prospects: M.Sc. in Biotechnology offers a range of dynamic career opportunities. Graduates can work in research and development, pharmaceuticals, and agricultural biotech. Roles include lab technicians, quality control analysts, and clinical researchers. Additionally, graduates can pursue careers in regulatory affairs, ensuring compliance with biotech regulations, or work in environmental biotech, focusing on sustainable solutions. Opportunities also exist in academia and education, where graduates can contribute to scientific knowledge and train future professionals.

#### **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks
		Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### **INSTRUCTIONS**

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Card online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers:**

The question paper shall follow the principles of Bloom's Taxonomy.

S. N.	Level	Questions /verbs for test						
1	Remember List, Define, tell, describe, recite, recall, identify, show v							
1	Kemember	where, etc.						
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.						
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify						
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.						
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare						
	Evaluate	etc.						
6	Create	Design, Formulate, Modify, Develop, integrate, etc.						

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

#### VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

**Table 2: Letter Grades and Grade Points** 

Letter Grade	Grade Points	Description
О	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
С	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

#### iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight)of that Course.

CGPA = 
$$\frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### D. Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdressal Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

(i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.

- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of the topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. This approach is also a student-centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visitthe library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

#### Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

#### SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course Category	۲			ngagement				N			
	14.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1	24MSBT1101R	Cell biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester I	2	24MSBT1102R	Biochemistry	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBT1103R	Bioinstrumentation	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Sen	4	24UMFS1101R	Fundamental of Statistics	MDC	2	0	0	0	0	0	2	40	60	0	100
	5	24UMPD1101R	Effective Communication	AEC	0			0	0	0	2	0	0	100	100
	6	24UMCC1101	Extra-curricular	Co and extra- Curricular	0	0	0	0	0	0	1	0	0	100	100
1		Tot	al								17				900
	S. No.	Course Code Course Title		Course		Engagement Maximum Marks for									
	110.	•		Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1	24MSBT1201R	Immunology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSBT1202R	Molecular biology, Genomics and Genetic Engineering	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBT1203R	Microbiome and Microbial Technology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester II	4	24UMPD1201R	Advanced communication	AEC	2	0	0	0	0	0	2	0	0	100	100
Seme	5	24MSBT1204R	Postgraduate Practice Teaching	SEC	1	0	0	0	0	0	1	0	0	100	100
	6	24MSBT2105R	Research Methodology and Statistical Analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using Microsoft excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSBT1205R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	0	100
	9	24UMCC1201	Co-curricular	Co and extra- Curricular	0	0	0	0	0	0	1	0	0	100	100
		Tot	al								22				1300

Semester III	S. N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSBT2101R	Bioinformatics	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	2		English (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	3	24MSBT2102R	Internship	Internship	0	0	0	0	0	0	4	0	0	100	100
	4	24MSBT2103R	Field Visit	Field Training	0	0	0	0	0	0	1	40	60	0	100
	5	24MSBT2104R	Research Project I	Research/ Industry Internship	0	0	8	0	0	0	4	0	0	100	100
	6	24MSBT2105R	Indian knowledge system	VAC	0	0	0	0	0	0	2	0	0	100	100
Se	Discipline specific Elective (Any three subjects to be selected)														
	7	24MSBT2106R	Plant and Animal Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	8	24MSBT2107R	Bioprocess and Fermentation Technology	DSE	3	0	2	0	0	0	4	40	60	100	200
	9	24MSBT2108R	Medical Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	10	24MSBT2109R	Food Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	Total										28				1300
Semester IV	S. No.	Course Code	Course Title	Course Category	Engagement				t		Maximum Marks for				
					L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSBT2201R	Research project II	Research/ Industry Internship	0	0	32	0	0	0	16	0	0	100	100
		D	fic Elective	fic Elective (Any two subjects to be selected)											
	2	24MSBT2202R	Agriculture Biotechnology	DSE	3	0	0	0	0	0	3	40	60	0	100
	3	24MSBT2203R	Environmental Biotechnology	DSE	3	0	0	0	0	0	3	40	60	0	100
	4	24MSBT2203R	Organic farming	DSE	3	0	0	0	0	0	3	40	60	0	100
	Total										22				300
		Grand To								89				3800	

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

		SEMESTER	. – I						
<b>Course Title</b>		Bioinst	rumen	tatior	1				
Course code	24MSBT111R	Total credits: 4	L	T	P	S	R	O/F	С
		Total hours: 45T+30P	3	0	2	0	0	0	4
<b>Pre-requisite</b>	Nil	Co-requisite				N	il		
Programme		Master of Scien							
Semester		Fall/ I semester of fir							
Course	_	edge about the working of di		Biome	edical I	nstrum	ents.		
Objectives		rinciple of different instrume							
	3. Working principle of chromatography, centrifugation Discuss Chromatography techniques including history, classification, principles, operation, analysis								
CO1	and application.	rapity techniques including i	nstory,	Classii	iicatioi	i, princ	ipies, c	рстаноп,	allalysis
CO2		on techniques, classification,	princi	oles, o	peratio	n and i	ts appl	ication.	
	-	gate Electrophoresis, its cate							1
CO3		functionality, dialysis, and b	_		•		1 ,	1	
CO4	Discuss radioisotop	e dating principles, including	g detect	ion, m	easure	ment, i	sotope	s, radiatio	on, units
CO4	and decay.								
CO5		ehensive understanding of pr	rinciples	s, and	practic	al appl	ication	skills in	various
		ods for scientific analysis.	CIT	1			<u> </u>		***
Unit-No.		Content	CH	411			Outcor		KL
		History; Classification;	10				illustra		
		operation, application & olumn, Adsorption		_	am me applic		iaiograj	phy and	
I	column, Partition, Thin layer, Ion exchange,			tileii	аррпс	anons			1,2
		n exchange, and Gel							
	Chromatography):	=							
	_	Types; Application;	5	Able	e to des	scribe,	illustra	te and	
II	Principle; rotors; o			expl	ain the	centri	fuge		1,2
	analytical centrifu								
	_	sis: Application; Types;	8				illustra		
III		er (Principle); Dialysis, e: Southern, Western, &		explain the electrophoresis			1,2		
	Northern blot	e. Southern, western, &							
	Radio- isotope da	ting technique:	7	Able	e to des	scribe,	illustra	te and	
137	Introduction, natur		,	1			isotope		1.2
IV	measurement of ra	dioactivity, radioisotopes							1,2
		radioactive decay.							
V		hniques: Introduction,	10				illustra		1,2
		ication of spectroscopy	20				oscope		, , , , , , , , , , , , , , , , , , ,
Practical		ecules from given sample	30				us ınstr	uments	
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	2. Column chrom								1,2,3,4
	3. Thin layer chro								1,2,5,1
	-	NA and protein molecules							
	by gel electrophor	_							

## **Text Books**

T1. Upadhyay. Biophysical chemistry: principle and technique. 12th edition. Himalaya Publishing House Pvt. Ltd; 2017.

## **Reference Books**

- R1. Kakkar. Atomic and Molecular Spectroscopy. 1st edition. Cambridge English; 2017.
- R2. Evans. Handbook of Chromatography.2nd Edition, Will ford Press; 2019.
- R3. Holme and Peck. Analytical biochemistry.3rd edition. Longman, 1983.

# **Other Learning Resources:**

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromatography

CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Discuss Chromatography techniques including history, classification, principles, operation, analysis and application.	1,4,5			
2	Define Centrifugation techniques, classification, principles, operation and its application.	1, 4, 5			
3	Explain and investigate Electrophoresis, its categorization, underlying principle, operational methods, pH meter functionality, dialysis, and blotting methodologies.	1,4, 5, 7			
4	Discuss radioisotope dating principles, including detection, measurement, isotopes, radiation, units and decay.	1, 7			
5	Develop the comprehensive understanding of principles, and practical application skills in various spectroscopic methods for scientific analysis.	1,9			

		SEMESTER -	– I								
Course title			hemistry								
Course code	24MSBT112R	Total credits: 4	L	T	P	S	R	O/F		C	
		Total hours: 45T+30P	3	0	2	0	0	0		4	
<b>Pre-requisite</b>	Nil	Co-requisite				Nil					
Programmes		Master of Scien									
Semester		Fall/I Semester of Fi									
<b>C</b>		. To study the structure of biomolecules, such as proteins, nucleic acids, carbohydrates and lipids									
	2. To know the functions and interactions of biomolecules, which will provide the knowledge of the structure of cells and the various functions performed by them which are associated with life?										
9		abolic pathways of biomolect		-					1110	<i>:</i>	
		t of chemical interactions and									
	macromolecules										
CO2	Understand the com	position, structure and functi	ion of the	biomo	lecules	}					
CO3	Enhance the underst	tanding on metabolism and p	hysiology	of cel	1.						
CO4	Analyse the concep	ts of secondary metabolites	for human	benef	ĭts.						
CO5	Prepare the base for	understanding courses such	as molecu	ılar bio	ology a	nd cell	ular fu	nctionir	ng a	ıt	
	molecular level.										
Unit-No.		Content	СН			ning (				KL	
	_	olecules (composition,	10	- 1	nowled	_		cept	1	,2	
		ctions): Carbohydrates, fucleic acids, Vitamins		of biomolecules, differentiating the various							
I	and Minerals.		- 1	omolec	_						
_	and winicials.			- 1	ndersta			- 1			
				- 1	pes and	_					
	<b>D</b>	0.1 1	10								
	_	and free energy), reaction	10		emonst indame			ra of			
		phosphorylation and		- 1	oenerg			- 1	1	,2	
	oxidative phospho		- 1	nd its ki		-	,		,		
II	Principle of catalys	sis, enzyme and enzyme		uı	ndersta	nding o	of				
	· ·	egulation, mechanism of			etaboli			-			
	'	Importance of enzymes in		-	plicati		clinical	and			
	diagnosis and thera	apy.		th	erapeu	tics.					
	Metabolism of bio	omolecules:	10	В	uild kn	owledg	ge of th	e	1	,2	
	· -	etabolism: Glycolysis and		bi	ochem	ical pat	hways	of			
	its regulation, Gluc	_		1 -	nthesis		-				
III	Glycogenolysis TO	•			the car	•					
		y, glyoxalate pathway.			pids wi oncept	th its re	egulato	ry			
	_	tty acid, odd chain fatty			лесрі						
		fatty acid metabolism.									
		bolism: Transamination,	8	U	ndersta	ndthe a	amino	acid	1,	2,3	
		ts types, urea cycle		- 1	nd nucl		-				
IV		olism: biosynthesis and		- 1	nd degr						
	degradation of pur	ines and pyrimidines			ochem	ical and	i regul	atory			
				"	oncept						
	Heme Metabolisn	n and Photosynthesis and	7	L	earn the	e synth	esis an	d	1,	2,3,	
	Secondary metab				eakdov		_	ain	4		
V	Heme synthesis an	=			nowled	_	he				
	-	ructure of chloroplast,			echanis		and are	nlv			
	_	dark reaction, Brief ondary metabolites		_	notosyn e conce			-			
	concept on the sec	ondary inclassifica	<u> </u>	ui	o conce	epi or s	COHU	ıı y			

	(Flavonoids, terpenoids, phenolic acids and alkaloids)		metabolites for mankind.	
Practical	Buffers: Preparation of acetate buffer, citrate buffer, tris buffer, phosphate buffer; Estimation of protein by Lowry's/Bradford method. Estimation of reducing sugar by DNS method. Estimation of RNA by orcinol method. Estimation of DNA by diphenyl amine method, Extraction and estimation of chlorophyll. Determination of total activity of amylase. Determination of total activity of protease, Qualitative analysis for protein, carbohydrate and its types, amino acid.	30	To apply the practical knowledge of biochemistry in variousfields	1,2,3,

T1. U Satyanarayana.Biochemistry.13th edition.Elsevier Health Sciences;2017.

## Reference books:

R1. David L. Nelson, Michael Cox. Leininger Principles of Biochemistry.7th Edition.WH Freeman; 2017.

R2.Rodwell et al. Harper's Illustrated Biochemistry.29th edition.McGraw Hill; 2012.

R3. Voet and Voet.Biochemistry.3rd edition.John Wiley & Sons, 2004.

Other learning resources: <a href="https://pubmed.ncbi.nlm.nih.gov/34809432/">https://pubmed.ncbi.nlm.nih.gov/34809432/</a>

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Improve the concept of chemical interactions and molecular organization of micro and macromolecules	1,3
2	Understand the composition, structure and function of the biomolecules	1, 4
3	Enhance the understanding on metabolism and physiology of cell.	1,3,4
4	Analyse the concepts of secondary metabolites for human benefits.	1, 2, 7
5	Prepare the base for understanding courses such as molecular biology and cellular functioning at molecular level.	1, 9.

Pre-requisite programme Semester  Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I Mo	prokaryotic 2. To define h 3. Familiarize prove understandi prove understandi scribe and able to le to understand t epare the base for  Membrane Structu f a model membr	Total credits: 4 Total hours: 45T+30P Co-requisite Bachelor of Science Fall/ I semester of first y udents understand the structure and eukaryotic cells, especial tow the cellular components are the cellular components under ting on the membrane structure ting on structural organization to understand the process of cellular how the cell communicates understanding advance course Content tree and Function: (Structure	in Bio year of es and p ly macr re used r rlying r e and its of cell a l division for fun	ourpos omole to gen- nitotic functi and its on actioni	es of ecules erate cell cioning organ	basic control of the	e ompor oranes,	and or	ganelles
Pre-requisite programme Semester  Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I Mo	Nil  1. To make structurf a model membrane struc	Total hours: 45T+30P  Co-requisite  Bachelor of Science  Fall/ I semester of first y  udents understand the structure and eukaryotic cells, especial tow the cellular components and the cellular components under ting on the membrane structure ing on structural organization understand the process of cellular communicates understanding advance course  Content	in Bio year of es and p ly macr re used r rlying r e and its of cell a l division for fun es in Bio	technoting to generate to generate to the function of the control	programmes of a coll of a	Ni y ramme basic c , meml and uti division g nelles.	onportoranes,	nents of	4 ganelles
rogramme Semester  Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I Mo	1. To make structurf a model membrane structurf	Co-requisite  Bachelor of Science  Fall/ I semester of first y udents understand the structure and eukaryotic cells, especial tow the cellular components and the cellular components under ting on the membrane structure ting on structural organization to understand the process of cellular communicates understanding advance course  Content	in Bio year of es and p ly macre used in rlying n e and its of cell a l division for fun es in Bio	technote to generate function its on actionic blogica	rolog progress of ecules erate c cell of ioning organ	Ni y rammo basic c , memb and uti division g nelles.	e ompor oranes,	nents of	ganelles
rogramme Semester  Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I Mo	1. To make structurf a model membrane structurf	Bachelor of Science Fall/ I semester of first y udents understand the structure and eukaryotic cells, especial tow the cellular components and the cellular components under ting on the membrane structure ting on structural organization to understand the process of cellular communicates understanding advance course  Content	year of es and p ly macre re used trlying re and its of cell a l division of function to so in Bio	ourpos omole to gen- nitotic functi and its on actioni	es of ecules erate cell cioning organ	basic control of the	e ompor oranes,	and or	ganelles
Semester  Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I M on c	prokaryotic 2. To define h 3. Familiarize prove understandi prove understandi scribe and able to le to understand t epare the base for  Membrane Structu f a model membr	Fall/ I semester of first yudents understand the structure and eukaryotic cells, especial tow the cellular components are the cellular components undering on the membrane structure ing on structural organization of understand the process of cellular communicates understanding advance course Content	year of es and p ly macre re used trlying re and its of cell a l division of function to so in Bio	ourpos omole to gen- nitotic functi and its on actioni	es of ecules erate cell cioning organ	basic control of the	ompor oranes, lize en	and or	ganelles
Course Objectives  CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No.  I No	prokaryotic 2. To define h 3. Familiarize prove understandi prove understandi scribe and able to le to understand t epare the base for  Membrane Structu f a model membr	udents understand the structure and eukaryotic cells, especial tow the cellular components are the cellular components undering on the membrane structure ing on structural organization ounderstand the process of cellular communicates understanding advance course Content	es and p ly macre re used a rlying re and its of cell a division for function	ourpos comole to gen- nitotic functi and its on ectioni	eses of ecules erate c cell of ioning organ	basic contents, memberships, me	ompor oranes, lize en	and or	ganelles
CO1 Imp CO2 Imp CO3 De CO4 Ab CO5 Pre Unit-No. I M O	prokaryotic 2. To define h 3. Familiarize prove understandi prove understandi scribe and able to le to understand t epare the base for  Membrane Structu f a model membr	udents understand the structure and eukaryotic cells, especial tow the cellular components are the cellular components undering on the membrane structure ing on structural organization ounderstand the process of cellular communicates understanding advance course Content	es and p ly macre re used a rlying re and its of cell a division for function	ourpos comole to gen- nitotic functi and its on ectioni	eses of ecules erate c cell of ioning organ	basic contents, memberships, me	ompor oranes, lize en	and or	ganelles
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Unit-No.  I No. n c	Membrane Structu	Content			al Sci		1.		
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o n c	of a model membr	re and Function: (Structure			Leari	ning C	Outcor	ne	KL
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c	nembrane protein	ane, lipid bilayer and				nembra	ne and	l	
	_	diffusion, osmosis, ion		fur	nction	1			
		ansport, membrane pumps,	7						1,2
		ing and regulation of							
	_	port, electrical properties of							
	nembranes)	-4:		Т-	1	the ba	_:_		
	_	ation and function of elles (Cell wall, nucleus,				al orga		n of	
	_	gi bodies, lysosomes,		1		ular or			
		alum, peroxisomes, plastids,	10	1110	140011	uiui oi	Samon		1,2
	_	ast, structure and function of							
	_	ts role in motility)							
III (	Cell Division and	Cell Cycle (Mitosis and		То	unde	rstand	the ba	sics	
	_	lation, steps in cell cycle,	10	of	how a	a cell d	ivides	and	1,2
r	egulation and con	atrol of cell cycle)	10		-	rtance	in cell		1,2
				_	cle.				
		igands and their receptors,				v about			
	-	or, signalling through G-				nication			
	_	ceptors, signal transduction messengers, regulation of		cel		ng mec	nanisn	is in	
		ys, bacterial and plant two-	8	Cei	115				1,2
		ns, light signalling pathways							
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		cation: (Regulation of		Kn	nowle	dge on	Basic		
h	aematopoiesis, ge	eneral principles of cell		reg	gulato	ry med	hanisn	ns of	
		ell adhesion and roles of	10	cel	11				1,2
		molecules, gap junctions,							
	xtracellular matri								
Practical 1	_	icroscopic observation of				e, illust		nd	
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	sample(s).	co in iviciosis of giveli		CX	ammilli	uiOII.			

# **Text Books**

T1: Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 4th edition. New York: Garland Science; 2002.

#### **Reference Books**

R1: Cooper GM. The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates; 2000.

R2: Ambrose and Dorothy. Cell Biology.2nd Edition.MEasty, ELBS Publications; 1970.

R3: Sharp, Lester W. Fundamentals of Cytology.1st edition.Mc Graw Hill Company; 1943.

Other Learning Resources: https://www.ncbi.nlm.nih.gov/books/NBK9839/?term=cell%20Biolpgy

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Improve understanding on the membrane structure and its functioning	1,3					
2	Improve understanding on structural organization of cell and its organelles.	1,3					
3	Describe and able to understand the process of cell division	1, 4					
4	Able to understand the how the cell communicates for functioning of the cell.	1,3					
5	Explain the Cellular communication, involving haematopoiesis regulation, cell adhesion, gap junctions, extracellular matrix, and integrins, ensures proper tissue structure and function	1, 3, 4, 7					

		SEMESTER-I								
<b>Course Title</b>		Microbiome and Mic	crob	ial Te	chnique	6				
Course code	24MSBT114R	Total credits: 4	L	T	P	S	R	O/F		C
		Total hours: 45T+30P	3	0	2	0	0	0		4
Pre-	Nil	Co-requisite			'	Nil				
requisite										
Programmes		Master of Science	in B	iotech	nology					
Semester	]	Fall/I Semester of First <b>Y</b>	ear	of the	Progra	mme				
	1.Introduction to Basic	Microbiology and microbion	me.							
	2.To develop and use c	ritical thinking and problem-	solvi	ng skil	lls througl	n the u	se of o	ase st	udie	S
	and reviews of scientifi									
9		cal perspectives important in	the	develo	pment of	microb	iolog	y along	g wi	th
	the current diversity in									
	•	m the various techniques ass								
	_	f the field and focus on prok	aryot	ic cell	structure	and fu	nction	S		
		r culturing microorganisms.								
	Elaborate the approach									
CO4	=	roorganisms in the field of E	nviro	nment	•					
CO5	Describe diversity of m	nicrobes								
Unit-No.		Content		CH	Lear	ning (	Outco	me	]	KL
I	Eukaryotic and Proka and types, Gram posi Actinomycetes, Intro fungi, molds and yea Fungus, Major polyst cell wall, Cell wall comicrobial secondary Probiotics.  Physical and chemica Sterilization by dry hagents- Alcohol, Ethy Aldehyde, Formaldel bacteriostatic. Effect technique: Gram stair culture, mixed cultur of pure culture isolati Spread plate methods & nutrient broth, type types of media, transpecchnique, Colony Formal position.	t of Microorganism & structuryotic cell, Bacterial Structuryotic cell, Bacteristics of sts, Hyphae and Body of accharide components of fundomponents of Fungi. Concept metabolites: Antibiotics,  all methods of sterilization: eat, moist heat, Chemical yl alcohol, Isopropyl alcohol, myde, Bacteriocidal, of dyes, Gases. Staining ming, Aerobic and anaerobic eand pure culture. Technique ion: Streak plate, Pour plate, s. Definition of media, Peptores of media, uses of different port media, Serial dilution forming Units (CFU) and it's tion and maintenance of pure	re eria, gal t of es	7	Knowle structur cells, di gram no positive introducits cell vita c	e of ba fference gative bacte: bacte: ction to wall co	and gria, o fung ompon n phys niques solatic media	l ween gram- i and ents ical, s of on, a and	1,2	
III	study, advantages, lin Unculturable bacteria methods studying of knowledge about bac genome concept. Mic	proaches for microbial diver mitations, Exploration of a: Culture independent molecunculturablebacteria, expand terial growth requirements, a probial dysbiosis a: its role, normal microflora	cular the net-	10	Knowled difference culture of culture is molecular requirem.  Knowled types of	de between dependent method legrowners.	ent an ndent nods, th	rent	1,2	
IV	immunity			8	present of body	on dif			1,2	۷

V	Diversity of microbes in terrestrial ecosystem, Microbes in extreme environments – thermophiles, psychrophiles, barophiles, acidophiles, alkaliphiles and halophiles, Microbial interactions: Competition, ammensalism, parasitism, mutualism, commensalism, synergism, Endophytism, Plant endophytes relation	10	Knowledge on Microbial diversity in terrestrial ecosystem and their resistance towards the extreme environments.	1,2
Practical	<ol> <li>Laboratory Safety, preparation for experiment, and laboratory waste management.</li> <li>Principle, operation and measurement of pH of a given sample</li> <li>Principle and operation of Hot air oven, Autoclave, Laminar airflow and centrifuge.</li> <li>Isolation of microbes from given sample by serial dilution techniques and estimation of the CFU (Pour plate and streak plate techniques also be learned)</li> <li>Staining (gram, acid fast, endospore or any appropriate staining) of the given microbial sample and observation under microscope.</li> </ol>	30	Describe, illustrate and explain and apply laboratory safety rules, set a microbiological experiment for microbial isolation, prepare slides by applying staining techniques and observe them under microscope.	1,2,3,4

T1. Michael J. Pelczar; E.C.S. Chan. Microbiology (An Application Based Approach). 12th edition. Tata McGraw Hill; 2010.

# Reference books

R1. L.E.J.R. Casida. Industrial Microbiology.2nd edition. New AGE International Publisher, 2019 R2. P. S. Bisen. Frontiers in microbial technology.1st edition. C.B.S. Publishers and Distributors; 1994 R3. Alan T. Bull. Biotechnology: International Trends and Perspectives, Issue 7. Organisation for Economic Cooperation and Development, 1982.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the evolution of the field and focus on	1, 4
	prokaryotic cell structure and functions	
2	Discuss the methods for culturing microorganisms.	1, 3, 4
3	Elaborate the approaches for diversity study.	1, 4, 7
4	Explain the role of microorganisms in the field of	1, 2, 7
	Environment.	
5	Describe diversity of microbes	1, 4, 7

		SEMESTER - 1	[							
<b>Course Title</b>		Fundamenta	l of S	tatis	tics					
Course code	24UMFS111R	Total credits: 3	L	T	P	S	R	O/F		C
		Total hours: 30T+30P	2	0	2	0	0	0		3
Pre-requisite	Nil	Co-requisite				Nil				
Programmes		Master of Science	in B	iotec	hnology	y				
Semester		Fall/I Semester of First	Year	of th	ne Prog	ramme	<u> </u>			
Course objectives	research  2. Introduce structure median, mod 3. Teach studer graphs  Improve understanding	erstand the role of statistics in adents to descriptive statistics de) and measures of dispersion at how to summarize and present of Descriptive Statistics and	, include the sent of the depth	uding ige, va data e nogra	measure ariance, s ffectively	es of cen standard y using	tral ter deviat tables,	ndency (1 ion). charts, a	nea	
CO2		o understand the Probability t	-							
CO3	Develop knowledge t	o understand the methods for	hypo	thesis	testing a	and biol	ogical	data anal	ysi	is.
CO4	Develop knowledge t	o understand the principles of	vario	ous st	atistical a	analyses	of dat	a.		
CO5	Develop knowledge o	on R language for data analysi	is							
Unit-No.		Content	(	СН	L	earning	g Out	come		KL
I	Statistics, concepts of sample. Data: quanticattributes, variables, nominal, ordinal, into			5		stical C	oncept	_		,2
11	histogram and ogive Tendency: mathemat of Dispersion: range	ar and graphical, including s. Measures of Central tical and positional. Measures quartile deviation, mean leviation, coefficient of and kurtosis.		5	Proficie Presenta	•		ysis		,2
III	simple, partial and m variables only), rank	inition, scatter diagram, nultiple correlation (3 correlation. Simple linear polynomials and exponential	Knowledge on Analyzin Bivariate Data and Relationships				ing	1	,2	
IV	Random experiments ample space, event, concepts of mutually events. Definition of relative frequency are space, Properties of events, Conditional probability Distribution, Binominal probability.	ot: trial, sample point and Operations of Events, exclusive and exhaustive opposability: classical and opposach. Discrete probability probability, Independence of probability, total and try rules, Normal probability all probability Distribution, Distribution, Bayes' theorem		8	Underst and Dis	_		pability		.,2
V	Testing of hypothes test, chi-square test. sample Kolmogorov Mann-Whitney Test,			7	Applica Testing	and Sta	tistical	Tests	1	,2
Practical	and environment for Syntax of R expressi	A programming language data analysis and graphics. ons: Vectors and assignment, nerating regular sequence,		30	A brief fordata visualiz	analysis	-	using R		,2, 3,4

logical vector, character vectors, Index vectors;	
selecting and modifying subsets of dataset	
2.Data objects: Basic data objects, matrices,	
partition of matrices, arrays, lists, creating and	
using these objects; Functions- Elementary	
functions and summary functions, applying	
functions to subsets of data. Data frames: The	
benefits of data frames, creating data frames,	
combining data frames, Adding new classes of	
variables to data frames; Data frame attributes.	
3.Importing data files: import. Data function, read	
table function; Exporting data: export. data	
function, cat, write, and write. Table functions,	
function, formatting output - options, and format	
functions; Exporting graphs -export. Graph	
function. Graphics in R: creating graphs using plo	
function, box plot, histogram, line plot, steam and	
leaf plot, pie chart, bar chart, multiple plot layout,	
plot titles, formatting plot axes; Visualizing the	
multivariate data: Scatter plot, Q-Q plot, P-Pplot.	
4.Performing data analysis tasks: Reading data	
with scan function, exploring data using graphical	
tools, computing descriptive statistics, one sample	
tests, two sample tests, Goodness of fit tests.	
5.Parametric test and non-parametric test	

**T1:** Methods in Biostatistics by K S Negi, ISBN:9789374735053,4th Edition, Year:2023, AITBS Publishers, INDIA **Reference books** 

R1; "Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig

R2: "Statistics" by David Freedman, Robert Pisani, and Roger Purves

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Improve understanding of Descriptive Statistics and	1, 4
	Demography.	
2	Develop knowledge to understand the Probability theory,	1, 4
	Distribution, and sampling methods.	
3	Develop knowledge to understand the methods for	1, 4
	hypothesis testing and Biological data analysis.	
4	Develop knowledge to understand the principles of various	1, 4
	statistical analyses of data.	
5	Develop knowledge on R language for data analysis	1, 4, 9

	SEMESTER - I									
<b>Course Title</b>	MINI RESEARCH (REVIEW OF LITERATURE-R1)									
Course code	24MSBT115R	Total credits: 2	L	T	P	S	R	O/F	С	
		Total hours: 30P	0	0	0	4	6	0	2	
<b>Pre-requisite</b>	Nil	Co-requisite			•	Ni	ĺ			
Programmes		Master of S	cience	in Bio	technol	logy				
Semester	Fall/I Semester of First Year of the Programme									
Course	To develop students scientific writing skill									
objectives		To develop stu	idenis s	Cleminic	witting	SKIII				
CO1	Employ databases a	nd library resources to g	gather o	original	research	, books	, and a	rticles effe	ctively	
CO2	Summarize and differentiate between various types of reviews, specifically analytical and descriptive reviews.									
CO3	Identify research top	Identify research topics and employ appropriate methods for collecting and filtering information.								
CO4	Critically analyze the contributions and in	ne demonstrations and finishers.	ndings	of prev	ious autl	nors to	compre	hend their	•	
CO5	Compose a detailed	review that explains the	e prosp	ects and	future d	lirection	ns of th	e chosen s	study.	

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Employ databases and library resources to gather original research, books, and articles effectively	1, 2, 3, 4
2	Summarize and differentiate between various types of reviews, specifically analytical and descriptive reviews.	1, 2, 3, 4
3	Identify research topics and employ appropriate methods for collecting and filtering information.	1, 2, 3, 4
4	Critically analyze the demonstrations and findings of previous authors to comprehend their contributions and insights.	1, 2, 3, 4
5	Compose a detailed review that explains the prospects and future directions of the chosen study.	1, 2, 3, 4,6

	SEMESTER - I Title EFFECTIVE ENGLISH (Communicative English & Soft Skills)										
<b>Course Title</b>	EFFE	CTIVE ENGLISH (	Comn	nunic	ative E	nglish	& Soft	Skills)			
Course code	24UMPD111R	Total credits: 2	L	Т	P	$\overline{S}$	R	O/F	С		
	24UMPD111R   Total credits: 2								2		
Pre-requisite											
Programmes		Master of Science in Biotechnology									
Semester		Fall/I Semester of First Year of the Programme									
Course objectives	<ol> <li>To strength</li> <li>To familiar</li> <li>Tointroduct</li> </ol>	To introduce the types of sentences and their significance.  To strengthen the students' vocabulary to enhance their speaking and writing skills. To familiarize the students with the importance of dress codes in various organizations. Tointroducethe3P's (Planning, prioritizing & performing) of Time Management.									
CO1	This course will ena	s course will enable students to analysis and identify the different types of sentences.									
CO2		e to integrate the skills of					fessiona	al communic	ation.		
CO3		e sessions will boost the									
CO4		about the effective and									
CO5	Introduction to Pho	netics and its importanc	e will i	mprov	e the lea	rners 'p	ronunci	ation			
Sl No		Content						utcome			
	Techniques of Effective Reading, gathering ideas and information from a text The SQ3R Technique			ve s s s t t and v tl	Identify and understand the structure of interrogative and assertive sentences. Transform and enhance grammatical accuracy and sentence formation skills.  Develop strategies for faster reading with better comprehension and improve the ability to recall and organize textual information systematically.						
MODULES	Module 3-Listening Skills What is listening? The Process of Listening, Factors that adversely affect Listening, Difference between Listening and Hearing, Purpose and Importance of Effective Listening, How to Improve Listening Process,				Understand the fundamental aspects and importance of listening. It also helps to enhance interpersonal and professional communication by practicing listening skills.				o d		
	Definition, Type of Conflict Management, Effects of Conflict Management, Methods to deal with Conflicts										
		lanagement Skills ne Management, Purpos Management, Basic Ti		1 1 1	Enhance productivity and stress management through effective time allocation and planning. It helps to understand the importance of time management in achieving personal a professional goals.						
	be given to the stud	solving activity: A situents and they will have ituation or solve the pro	to tell ι								

T1: Wren, P.C and MartinH. 1995. High School English Grammar and Composition, S Chand Publishing.

T2: English Grammar in Use, Raymond Murphy 4th edition, CUP.

T3: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

# Reference books:

- R1; English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- R2: Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Analyse and identify the different types of sentences.	1, 5
2	Able to integrate the skills of reading and speaking in professional communication.	1, 5, 9
3	Illustrate code Etiquette sessions will boost their confidence and morals.	5, 6, 9
4	Describe about the effective and efficient utilization of time.	5, 9
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	1, 5, 9

Course code   24MSMB121R		SEMESTER - II										
Pre-requisite   Nil   Co-requisite   Nil	<b>Course Title</b>	Immunology										
Pre-requisite   Nil   Co-requisite   Nil   Programmes   Master of Science in Biotechnology	Course code	24MSMB121R Total credits: 4 L T P S R O/F							С			
Semester   Spring/II Semester of First Year of the Programme			Total hours: 45T+30P	3	0 2 0 0 0					4		
Semester   Spring/II Semester of First Year of the Programme	<b>Pre-requisite</b>	Nil Co-requisite Nil						•				
1. To make students understand the Immune system and its components, immune response, antigen, antibody, immunity, Hypersensitivity, Autoimmunity etc.   2. To make students learn various immunological concepts.   3. To make skilled students in diagnostic techniques.   CO1	Programmes		Master of Scienc	e in Bio	otechn	ology						
Course objectives   2. To make students learn various immunological concepts.   3. To make students learn various immunological concepts.   3. To make students in diagnostic techniques.	Semester	S	pring/II Semester of Fir	rst Year	r of th	e Prog	gramr	ne				
Objectives   2. To make skilled students in diagnostic techniques.		1. To make studen	ts understand the Immune s	ystem ar	nd its c	ompon	ents, ir	nmune	respons	se,		
3. To make skilled students in diagnostic techniques.  CO1 Describe the immune system and its components and their mode of action in defense mechanisms.  CO2 Outline antigen and antibody structure, types, and properties including the processes of monoclonal and polyclonal antibody production  CO3 Apply the knowledge of different immunological diagnostics tests, their principle, and interpretations aiding in the detection of the underlying cause of the diseases.  CO4 Interpret transplantation and cancer immunology findings and their role in research.  CO5 Discuss immunological disorders like autoimmunity and hypersensitivity, their prevention strategies, and management  Unit-No. Content CH Learning Outcome KL  I Introduction to immunology - Definition, history, scope of immunology. Overview of the immune system-cells and organs of the immune system-cells and organs of the immune system-limmune response. Immunity types of immunity- Innate and acquired immunity. APC.  II Antigens – General features, haptens, adjuvants, epitopes. Antibody – Structure, types, antibody mediated effector functions – opsonisation, antibody activated complement, ADCC, isotypes, allotypes, idiotypes, idiotypes, idiotypes, idiotypes, idiotypes, antibody mediated effector functions – production of monoclonal antibodies, immunotoxins, abzymes, extraction of antibodies. Expression of immunoglobulin genes- antibody diversity, class switching of Immunoglobulins  III Antigen-antibody viersaction – principle and application – RIA, ELISA, Western blotting, Immunofluorescence, Complement system – classical and alternative pathway, functions  III Antigen-antibody interaction – principle and alternative pathway, functions  III Antigen-antibody formation, HLA typing, MHC, T cell receptors, immunological diagnostic tests and their process of different immunological diagnostic tests immunology and immune immunology and immune immunology and immune	Course	antigen, antibod	y, immunity, Hypersensitiv	ity, Auto	oimmu	nity etc						
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CO2 Outline antigen and antibody structure, types, and properties including the processes of monoclonal and polyclonal antibody production  CO3 Apply the knowledge of different immunological diagnostics tests, their principle, and interpretations aiding in the detection of the underlying cause of the diseases.  CO4 Interpret transplantation and cancer immunology findings and their role in research.  CO5 Discuss immunological disorders like autoimmunity and hypersensitivity, their prevention strategies, and management  Unit-No. Content CH Learning Outcome KL  I Introduction to immunology — Definition, history, scope of immunology. Overview of the immune system-cells and organs of the immune system. Immune response-Humoral and cell mediated immune response-Humoral and cell mediated immune response. Immunity- types of immunoly- hande and acquired immunity, APC.  II Antigens — General features, haptens, adjuvants, epitopes, Antibody — Structure, types, antibody mediated effector functions — opsonisation, antibody activated complement, ADCC, isotypes, allotypes, idiotypes, Antibody production and purification — production of monoclonal antibodies, immunotoxins, abzymes, extraction of antibodies. Expression of immunoglobulin genes- antibody diversity, class switching of Immunoglobulins  III Antigen-antibody interaction — principle and application — RIA, ELISA, Western blotting, Immunofluorescence, Complement system — classical and alternative pathway, functions  IV HIAA — Theories of antibody formation, HIAA typing, MHC, T cell receptors,												
and polyclonal antibody production  CO3	CO1	Describe the immune	system and its components	and their	r mode	of acti	on in o	lefense	mechan	nisms.		
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Interpretations aiding in the detection of the underlying cause of the diseases.    CO4		and polyclonal antibo	dy production									
Interpret transplantation and cancer immunology findings and their role in research.    CO5	CO3	Apply the knowledge	of different immunological	diagnos	tics tes	ts, thei	r princ	iple, ar	nd			
Discuss immunological disorders like autoimmunity and hypersensitivity, their prevention strategies, and management   CH												
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HLA typing, MHC, T cell receptors, immunology and immune												
	IV											
I I ransplantation immunology – Graff I effectors			_			_	y and i	ımmun	e			
		-	••		effec	ctors.						
rejection, immune suppressive therapy, immune tolerance, clinical transplantation 8 1,2		_		Q						1.2		
immune tolerance, clinical transplantation Immune effectors – Cytokines, IL and			_	σ						1,2		
functions, cell mediated cytotoxicity, NK												
cells, TNF, Interferons, Inflammation,			-									
leukocyte activation, and migration												

V	Hypersensitivity and types, Autoimmunity,		Knowledge on Hypersensitivity,	
	Cancer and immune system – tumour		Autoimmunity, cancer	
	antigen, tumour evasion and	10 A	immunology, immunodeficiency	1,2
	immunotherapy of cancer, AIDS – primary	10	and vaccines	1,2
	and secondary immunodeficiency.			
	Vaccines and its types			
	Precipitation Reaction:	30	Able to operate ELISA, RIA	
	i. Double Diffusion Reaction			
	ii. Single Diffusion Reaction			
	iii. Ouchterlony immunodiffusion			12
Practical	iv. Immunoelectrodiffusion			1,2, 3,4
	Agglutination Reaction: (Qualitative and			3,4
	quantitative)			
	WIDAL, ASO, VDRL, RPR, CRP			
	Blood grouping and Rh typing, ELISA			

T1. Punt et al. Kuby Immunology 18th Edition. W H Freeman &Co (Sd); 2018.

## Reference books

- R1. Abbas.Cellular and Molecular Immunology.10th edition.Elsevier; 2021.
- R2. Martin et al. Roitt's Essential Immunology (Essentials).13th edition.Wiley-Blackwell, 2017.
- R3. Westwood.Practical Immunology.4th edition.Wiley-Blackwell; 2002.

# Other learning resources:

https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the immune system and its components and their mode of action in defense mechanisms.	1, 2
2	Outline antigen and antibody structure, types, and properties including the processes of monoclonal and polyclonal antibody production	1, 4
3	Apply the knowledge of different immunological diagnostics tests, their principle, and interpretations aiding in the detection of the underlying cause of the diseases.	1, 4
4	Interpret transplantation and cancer immunology findings and their role in research.	1, 4
5	Discuss immunological disorders like autoimmunity and hypersensitivity, their prevention strategies, and management.	1, 2, 3

Course Title MOLECULAR BIOLOGY,GENOMICS AND GENETIC ENGINEER  Course code 24MSBT122R Total credits: 4 L T P S R O/F  Total hours: 45T+30P 3 0 2 0 0 0	ING C						
	$\mathbf{C}$						
	4						
Pre-requisite Nil Co-requisite Nil							
Programmes Master of Science in Biotechnology							
Semester Spring/II Semester of First Year of the Programme							
To teach in depth about genome and its arrangement in eukaryotes and microbe							
Course  2. To teach the central dogma of life (replication, transcription, translation and post transcriptional modifications) with the best possible teaching tools (explanation/po							
chiectives transcriptional modifications) with the best possible teaching tools (explanation	power						
point presentation/seminar/assignment) and with utmost attention.							
3. Important topics like mutation, DNA damage and repair are explained.  CO1 Explain the fundamental of genomics concepts such as genome, DNA structure, RNA, processing the such as genome, DNA structure, RNA, p	otoing and						
the central dogma.	otenis and						
CO2 Explain the methods for mapping genomes, describe markers, linkage analysis with diffe	rent types						
of organisms, physical mapping, and basics of genome sequencing, shotgun sequencing.	ient types						
CO3 Compare prokaryotic and eukaryotic genomes, including the presence of extra chromoso	nal DNA						
and examine the vital function of DNA binding proteins in gene expression and regulation							
CO4 Illustrate the dynamics of genome access, encompassing aspects such as euchromatin,							
heterochromatin, chromosome painting, nucleosome modifications, histone acetylation, l							
modifications, DNA methylation-induced gene silencing, and gene regulation in both pro-	karyotes						
and eukaryotes.	1.0						
Discuss the mutation causes, types of DNA mutation and DNA repair mechanisms, cruci	al for						
maintaining genetic stability and impacting human health.	IZI						
Unit-No. Content CH Learning Outcome	KL						
Introduction to genomics, definitions of genome,  DNA structure and composition, RNA and the  refreshing the existing	ıa						
transcriptome, proteins and the proteome, the	1,2						
central dogma							
Mapping of genomes, markers for genetic Sequencing techniques in							
mapping, the basis to genetic mapping, linkage detail followed by linkage							
II analysis with different types of organisms, 10 mapping	1,2						
physical mapping, basics of genome sequencing,							
shotgun sequencing							
Genomes of prokaryotes and eukaryotes, extra  Knowledge on DNA	,						
chromosomal DNA, role of DNA binding replication in prokaryotes a	and						
proteins in genome expression: methods for studying DNA binding proteins and their lower eukaryotes with special emphasis on the proteins a	nd 1,2						
attachment sites, special features of DNA enzymes involved	1,2						
binding proteins, interaction between DNA and .							
its binding proteins							
Accessing the genome: euchromatin and Genome organisation is							
heterochromatin, chromosome painting, discussed in detail with							
nucleosome modifications and genome various post translational							
IV expression, histone modification, acetylation, 8 events along with regulator	ry   1,2						
DNA modifications and genome expression, mechanisms							
gene silencing by DNA methylation, gene							
regulation in prokaryotes and eukaryotes  Introduction to genetic engineering, Different  By the end of this course,							
DNA manipulating enzymes, methods for students will understand							
isolating DNA, vectors for bacteria, plant and genetic engineering							
V animals, expression vectors, DNA libraries, 10 techniques, use vectors,	1,2						
application of genetic engineering. evaluate expression vector							
and propose innovative							
applications.							

	Isolation of genomic DNA., Isolation of plasmid	30	Knowledge on extraction of	
	DNA, Polymerase chain reaction, Endonuclease		DNA and plasmid from	
Duastiasl	digestion of DNA and analysis of DNA		biological samples followed	1,2,
Practical	fragments by agarose electrophoresis.		by their in vitro	3,4
			amplification and studying	
			RFLP profile	

T1. Watson et al. The Molecular Biology of the Gene.7th edition.Pearson Publication; 2013.

## Reference books

- R1. Alberts et al. The Molecular Biology of the Cell.7th Edition. WW Norton & Co, 2022.
- R2. Rastogi.Cell and Molecular Biology.4th edition.New Age International Private Limited; 2020.
- R3. Som. Practical Manual of Molecular Biology.1st edition.KAAV Publications, 2018.

## Other learning resources:

https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the fundamental of genomics concepts such as genome,	1,9
	DNA structure, RNA, proteins and the central dogma.	1, 9
2	Explain the methods for mapping genomes, describe markers, linkage	
	analysis with different types of organisms, physical mapping, and	1, 4
	basics of genome sequencing, shotgun sequencing.	
3	Compare prokaryotic and eukaryotic genomes, including the	
	presence of extra chromosomal DNA and examine the vital function	1, 2
	of DNA binding proteins in gene expression and regulation.	
4	Illustrate the dynamics of genome access, encompassing aspects such	
	as euchromatin, heterochromatin, chromosome painting, nucleosome	
	modifications, histone acetylation, DNA modifications, DNA	1, 4
	methylation-induced gene silencing, and gene regulation in both	
	prokaryotes and eukaryotes.	
5	Discuss thegenetic engineering techniques, including DNA	
	manipulation, vector use, and DNA libraries, and explore their	1, 2, 7
	applications.	

		SEMESTER -	- II							
Course Tit	le	Bioin	format	ics						
Course cod	e 24MSBT123R	Total credits: 3	L	T	P	S	R	O/F	١	C
		Total hours: 30T+30P		0	2	0	0	0		
D	NIST	C	2	0	2	0	0	0		3
Pre-	Nil	Co-requisite				Nil				
requisite		M. A. CO.	· D.	4 1						
Programme	es	Master of Science								
Semester	1 7 1	Spring/II Semester of Fi				,		1		
Course		n and retrieve biological inform ge on computational database r				_			Riolo	M
objectives	n	dea on the structural biology us	_	-	tem an	u 115 a	ррпса	uon m	DIOIO	gy
CO1		n Bioinformatics and its signific			d of bio	ologic	al data	analys	is	
CO2		abase management system and								
CO3		e on sequence submission tools					engine	es		
CO4		juence alignment and analysis.			8144113					
CO5		of computer aided drug design	ino							
	Learn the concept	or comparer aided drug design	5							
Unit-No.	Content			СН	Lear	ning	Outc	ome	KL	
I		informatics, Scope and Applica	tions	7		vledge		01110		
		Introduction to various molecul		· .	1	_	tics an	d its		
	data and databases,	Importance of Computers/IT in	n the		relati	on wi	th			
	field of Biology. Fl	atfileformats. Biological Datab	ase		mole	cular l	oiolog	y and		
		eral Introduction of Biological			its ap	plicat	ion.		1,2	,
	Databases: Nucleot							1,2	,	
		. Protein sequence databases								
		R, GenPept), Specialized Genor	me							
		IGR etc). Structure databases I PDB, NDB, MMDB)								
II		nent System: Basic Concept of		6	Forn	nation	of a			
11	_	of Entities, Attribute, Keys,		0		base a				
		e level architecture of a DBMS	,			icatio				
	_	MS, Advantages & Disadvantag			biolo				1,2	
	a DBMS.File Base	a DBMS.File Based System, Traditional System,								
	• •	DBMS types Hierarchical, Network, Relational Data								
	Model etc									
III		tabase search engines: Text-bas		7	1	wledg	e on			
		trez, DBGET /Link DB). Seque			diffe		<i>.</i> ·			
	-	arch engines (BLAST and FAS n engines (ScanProsite and	1A).			nform	ancs ines a	nd	1,2	,
		re similarity-based search engin	ies			_	cations		1,2	
		tension, VAST and DALI).	CS		1	eving		, 111		
		ExPASy server, EMBOSS.								
IV		alignments: Sequence similarity	/,	5	A go	od kn	owled	ge		
	_	ogy. Global and local alignmer			_	equen				
		ast, Application of Blast tool,			align	nment	and its	8	1,2	,
		alignments and Application of			appl	icatio	1			
	multiple sequence a									
V	_	drug design- concept, methods		5			owled;	- ا		
		es, various computational meth	ods			_	signin	· 1	1.0	,
		he drugs, CADD software			1	-	mpute		1,2	,
	uemonsuadon. Pro	tein homology modeling				as pro elling	otein 3	ע		
Duc 24:1	Data retrieval from	different biological database		30		vledge			1 2	2 4
Practical	Dam Touteval HOII	annoioni ototogicai database		50	ISHOV	. rouge	. 011		1,2	2,3,4

Sequence alignment through BLAST	different biological	
Protein homology modeling	databases and	
Phylogenetic Analysis through MEGA software	sequence alignment	
Demonstration of Drug designing	tool.	

T1. Harisha S. Fundamental of Bioinformatics.3rd edition.Dreamtech Press, 2019.

#### Reference books

- **R1**. Sharma T. R. Genome Analysis and Bioinformatics: A Practical Approach (English) (Paperback). 1st edition.Dreamtech Press; 2019.
- R2. Orengo C.A. et al. Bioinformatics: Genes, proteins and computers. 1st edition. Taylor & Francis, 2002.
- **R3.**Kangueane P., Mathura V. Bioinformatics: A Concept-Based Introduction. 1st edition. Springer-Verlag New York Inc. 2009.

# Other learning resources:

https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	A basic concept on Bioinformatics and its significance in the field of biological data analysis	1, 4, 9
2	Knowledge on database management system and its application in Biology	1, 4, 5
3	A good knowledge on sequence submission tools as well as biological search engines	1, 4, 5
4	Knowledge on sequence alignment and analysis.	1, 4
5	Learn the concept of computer aided drug designing	1, 3, 4

		SEM	ESTER -	II							
<b>Course Title</b>	Co	ncepts of Or	ganic Cu	ltivati	on (Ge	eneric	Electi	ve)			
Course code	24MSBT124R	Total credits	s: 2	L	T	P	S	R	O/F	(	7
		Total hours:	30T	2	0	0	0	0	0	2	2
Pre-requisite	Nil	Co-requ	iisite				Nil				
Programme	Offere	d by Progran		techno	logy fo	or stud	lents o	f othe	er		
		v 8	Faculty								
Semester	Fall/Spring/II,	IV(UG)/II, I				her tha	an Fac	ulty o	f Scier	ıce	
		Introduction to Concept of Organic cultivation									
Course	2. To discuss the O				ts impo	rtance a	and ber	nefits.			
objectives	3. To discuss the m	ethods associa	ted with or	ganic f	arming	– mulc	hing, c	rop rot	ation, ti	llage,	
	bio-fertilizer etc.										
CO1	Explain the OF, its prir	ciples and ben	efits for he	ealth an	d socie	ty.					
CO2	Discuss the relation bet	tween OF and	natural pro	cesses	such as	nutrier	nt cycle	s.			
CO3	Explain cultural, mech	anical, and biol	logical me	thods fo	or crop	protect	ion and	mana	ge orga	nic	
	production for various		-		-				-		
CO4	Illustrate crop protection	on strategies, in	cluding bi	opestic	ides and	d organ	ic meth	ods fo	r key cı	ops, a	ınd
	understand yolk function	ons.									
CO5	Discuss the soil less far	rming system.									
Unit-No.	Content	t	C	Н		Learn	ing O	utcom	ie	KL	1
I	Introduction to Orga	nic Farming	7	1	Un	derstan	d orgar	nic farr	ning,		
	(OF); Development of				its 1	types, p	rincipl	es, ben	efits		
	Principles and Types				and	l scope.	•				
	Biodynamic Farming									1,2	•
	Benefits of OF; Conv										
	Farming (CF) Vs (OF	); Scope of									
	OF.	G 31 -31				., .	11	1			
II	<b>OF System</b> ; Soil and	• 1	8			scribe i					
	Choice of crop/ variet				1	olain the	e organ	ic iarm	ning		
	Propagation – Seed, 1 material and seed trea				sys	tem					
	Crop rotation, Intercre									1,2	,
	Water Management, (									1,2	•
	Manuring, Mulching,										
	Composting, Vermice	omposting,									
	Organic Manure, Bio										
III	Crop Protection: Cu		5		Des	scribe a	nd exp	lain th	e		
	Mechanical method; I	Biopesticides			var	ious wa	ays for	protect	ing		
	and Botanical Pesticio	les, Bio-			pla	nts				1,2	
	control agents, Weed										
	Management										
IV	Organic crop produc		5		l l	scribe a	_		<b>I</b>		
	Rice, Zinzer, Turmeri				_	anic pr	oductio	n of ci	rop	1,2	)
	and Vegetables Yolk-	its function			pla	nts				-,-	
	and significances		-	,	-	••	-	1			
V	Concept on modern	_	5			scribe a			e	1.0	,
	farming methods – H					dern m		ΟΙ		1,2	•
	Aquaponics, Hydropo	nics			agr	iculture	•				

T1. J. M. Fortier. The Market Gardener – A successful Grower's Handbook for Small- Scale OF. 1st edition. New Society Publishers, 2014.

# Reference books

- R1. A. L. Hansen. Organic Farming Manual: A Comprehensive Guide To Starting And Running A Certified Organic Farm. 1st edition. Storey Publishing LLC, 2010.
- R2. C. SarathChandran et al. Organic Farming: New Advances Towards Sustainable Agriculture Systems, 1st edition, Springer; 2019.
- R3. D. Nandwani (eds). Organic Farming for Sustainable Agriculture.1st edition, Springer; 2016.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the OF, its principles and benefits for health and society.	1, 2, 3, 4
2	Discuss the relation between OF and natural processes such as nutrient cycles.	2, 7
3	Explain cultural, mechanical, and biological methods for crop protection and manage organic production for various crops.	3, 4, 7
4	Illustrate crop protection strategies, including biopesticides and organic methods for key crops, and understand yolk functions.	3, 4, 7
5	Discuss the soil less farming system	3, 5

		SEMESTE	R - II						
<b>Course Title</b>		Techno Pi	rofessi	onal Sl	kills - I				
Course code	24MSBT125R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours: 60P	0	0	4	0	0	0	2
<b>Pre-requisite</b>	Nil	Co-requisite				Nil	1		•
Programme		Master of Sc	ience i	n Biote	chnolo	gy			
Semester		Spring/II semester o	f first	year of	f the p	ogram	me		
Course objectives	2. To enable 3. To make Explain polytene	op proficiency in different e students to interpret morp skilled students in microbi chromosomes in Drosophi	ohologica ologica la for cl	es of mi l and m nromoso	croorga olecular omal ana	nisms ar biology alysis.	nd chro	mosomes	-
CO2		n grasshopper testis or onio			rstand o	ell divi	sion.		
CO3		aining techniques for micr		nalysis.					
CO4	11.	s for bacterial differentiation							
CO5	-	nduct agarose gel electrop	horesis	, and us	e streak	ing met	hods fo	r microbi	al
	culture.								***
Unit-No.		Content		C	H J	Learni	ng Out	come	KL
I	<ol> <li>Study of m flower bud</li> <li>Staining ted</li> <li>Capsulation</li> <li>Spore</li> <li>Acid to the Negat</li> <li>IMVIC test</li> <li>Different S preparation</li> <li>Isolation of from differ</li> <li>Preparation</li> </ol>	chniques: ale stain stain fast stain ive staining t treaking methods for pure	culture zation	3		_	nd the dization	and	1,2, 3,4

T1. Aneja.Experiments in microbiology, brand petrology, tissue culture, and microbial biotechnology.6th Edition, New Age international publication; 2022.

## Reference books

- R1. Brown. Benson's Microbiological Applications Laboratory Manual in General Microbiology. 10th edition.McGraw-Hill Education, 2006.
- R2. Atlas. Handbook of Microbiological Media, 4th edition. ASM press, 2010.
- R3. Mishra et al. Cell Biology.12th Edition.Mahaveer Publications, 2020.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1.	Explain polytene chromosomes in Drosophila for chromosomal analysis.	1, 2, 4
2.	Discuss meiosis in grasshopper testis or onion buds to understand cell division.	1, 2, 3
3.	Perform various staining techniques for microbial analysis.	1, 5
4.	Apply IMVIC tests for bacterial differentiation.	1, 2, 5
5.	Prepare buffers, conduct agarose gel electrophoresis, and use streaking methods for microbial culture.	1, 2, 5

		SEMESTER -	II							
<b>Course Title</b>	MIN	II RESEARCH (REVI	EW (	OF LI	ΓERA	TURE	-R2)			
Course code	24MSBT127R	Total credits: 2	L T P S R O/F C							
		Total hours: 30P	0	0	0	4	6	0	2	
<b>Pre-requisite</b>	Nil	Co-requisite		•	•	Nil	•			
Programmes		Master of Science	e in B	iotech	nolog	y				
Semester	Sp	ring/II Semester of Fi	rst Ye	ar of t	the Pro	gram	me			
Course	To develop students sci	entific writing skill								
objectives										
CO1	Employ databases and	library resources to gather	origin	al resea	arch, bo	oks, an	d article	es effectiv	vely	
	Summarize and different descriptive reviews.	ntiate between various typ	es of re	eviews,	, specifi	cally a	nalytica	l and		
CO3	Identify research topics	and employ appropriate r	nethod	s for co	ollecting	g and fi	ltering i	informati	on.	
		Critically analyze the demonstrations and findings of previous authors to comprehend their contributions and insights.								
CO5	Compose a detailed rev	riew that explains the pros	pects a	nd futu	ire direc	ctions o	f the ch	osen stud	ly.	

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Employ databases and library resources to gather original research, books, and articles effectively	1, 2, 3, 4						
2	Summarize and differentiate between various types of reviews, specifically analytical and descriptive reviews.	1, 2, 3, 4						
3	Identify research topics and employ appropriate methods for collecting and filtering information.	1, 2, 3, 4						
4	Critically analyze the demonstrations and findings of previous authors to comprehend their contributions and insights.	1, 2, 3, 4						
5	Compose a detailed review that explains the prospects and future directions of the chosen study.	1, 2, 3, 4,6						

		SEMESTER - II	[							
Course Title		Research Methodology	and St	tatistical A	Analysi	s				
Course code	24UMRM121R	Total credits: 2	L	T P	S	R	O/F	C		
		Total hours:15T+60S	1	0 0	4	0	0	2		
<b>Pre-requisite</b>	Nil	Co-requisite			Nil					
programme		Master of Science	e in Bio	otechnolog	gy					
Semester		Spring/II semester of Fir								
		e aims to enhances the					_			
methodology, including theory of science and qualitative and quantitative methods in										
Course			o enhance the students' skills for developing critical thinking th							
objectives		erature review in different do		_	-		_	SKIIIS TO		
· ·	preparation of a research proposal for a master' thesis project/Mini research.  3. To develop Students competency in planning, conducting, evaluating and present the proposal for a master' thesis project/Mini research.									
	research pro		anning,	conducting	g, evalua	aung ar	ia pres	enting a		
CO1	_	asic knowledge of Research	method	c						
CO2		e knowledge of Research M								
	_	to gain the Skill questionna								
CO3		•		•		D 1				
CO4		to acquire the knowledge of	f basic I	Report/disse	ertation .	Procedi	ıre.			
CO5	Knowledge on differ		~							
Unit no		Content	СН		ing Ou	itcome	9	KL		
I		ogy- An Introduction-	2	Knowled		1,2				
	meaning and object			fundame research		_				
		motivation in research, types and significance of research, criteria of good research.			the me		nd			
			objective		_	iid				
	Defining the Research Problems- definition of research problem, necessity of defining			oojeenve	.5 01 1 <b>0</b> 50	Jul 011				
	research problem									
II	_	neaning and need of	4	Able to u	nderstan	d and		1,2		
	research design, fea	tures of a good design,		apply the	fundam	ental				
	different research d	_		principles						
	1	steps in sampling design,		design, in	_					
		nination, criteria for		meaning		essity of	f			
	selecting a sampling	_		research o	design					
		pes of sampling design, gn, Principles of Design of								
		way ANOVA, Two- Way								
		BD, LSD, 22, 23 Factorial								
	Design	, , , , -								
III		ces of data collection,	3	A good k	nowledg	ge on		1,2		
	tools of data collect	tion, Nominal, ordinal,		different t	types of	data an	d			
	interval and ratio			identify v			and			
	– Attitude scale cor			tools for o	data coll	ection				
	measurement, rating	_								
		se of scale in statistical								
		for interviews preparation								
	instruments and iter	, development of survey								
	questionnaire	in anaryois for the								
IV	I .	izing research report,	3	Able to o	rganize :	and wri	te a	1,2		
• •		report, Different steps of		comprehe	_			1,2		
	writing report,			report						
	lay out of the resear	rch report, How to								
	organize thesis/Dis	sertation, mechanics of								
	writing research rep	ort, standard methods of								

	1 1 1.			
	quoting- presenting the result, written and			
	oral reports, Uses of abstract, format of			
	research report, presentation of statistics -			
	tabular and graphic references and uses of			
	references, Bibliography and presentation of			
	bibliography			
V	Intellectual property right (IPR), Introduction	3	Knowledge on importance	1,2
	and the need for IPR, IPR in India and		of Intellectual Property	
	worldwide, Patents, Trademarks, Copyright		Rights (IPR) both in India	
	& Related Rights, Industrial Design,		and globally	
	Traditional Knowledge and Geographical			
	Indications, Patentable and non-patentable,			
	patenting life, Filing of a patent application,			
	The different layers of the international			
	patent system, Case studies on Basmati rice,			
	Turmeric, and Neem patents			
	Laboratory using R Software:	60	Knowledge on various	1,2,3,4
	1 Analysis of One-way ANOVA;		statistical experiments and	
	2 Analysis of Two-way ANOVA;		simulations using R	
	3 Analysis of CRD			
	4 Analysis of RBD			
Practical	5 Analysis of 22 and 23 Factorial Experiment			
Fractical	6 Simulation-I using R (Bernoulli, Binomial,			
	Poisson and Geometric distribution.).			
	7 Simulation-II using R (Exponential and			
	Normal distribution).			
	8 Simple random Sampling			
_	9 Stratified Random Sampling			

**T1:** Methods in Biostatistics by K S Negi, ISBN:9789374735053,4th Edition, Year:2023, AITBS Publishers, INDIA

#### Reference books

R1. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn& Bacon.

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Students will have basic knowledge of Research methods.	2, 4, 9							
2	Students will gain the knowledge of Research Methodology.	2, 4, 9							
3	Students will be able to gain the Skill questionnaire development.	2, 4, 5							
4	Students will be able to acquire the knowledge of basic	4, 5							
	Report/dissertation Procedure.								
5	Knowledge on different IPR rights	6, 7							

		SEMESTER -	· II						
<b>Course Title</b>	UNIVERSAL H	UMAN VALUES (UHV	) + PI	ROFE	SSION	AL ET	THIC	S	
Course code	24UUHV101R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours:15T+30P	1	0	2	0	0	0	2
Pre-requisite	Nil	Co-requisite				Nil			
Programme		e in Biotechnology							
Semester		ter of First year of the p							
Course objectives	'SKILLS' to all human be 2. To facilitat profession of the Hum of Universa 3. To highligh human con interaction	e the development of a Holi as well as towards happines an reality and the rest of Ex al Human Values and move at plausible implications of duct, trustful and mutually with Nature	stic pe s and p s and p istence ment to such a fulfilling	rspectionsperior	ity, which we amore ity base a holist value-b c unders an beha	ch are the stude of a control o	ents toverorrect bective ring in g in term	aspiration  vards life  understate  forms the  a natural  ms of eth  ually enro	e and ending ne basis way nical
CO1		f this course is explorational			-	-		nvolves	a
602	1 -	nal study of the human bein		-vis the	e rest of	existen	ce.		
CO2	•	ogma or value prescriptions		- 1					
CO3	-	f-investigation and self-exp						·11·2 / 1 /	
CO4		as truth or reality is stated as based on their Natural Acc	•	-					-
CO5		exploration takes the form							
		nen to continue within the st							
Unit		C	ontent	t					
I	<ul> <li>Self-Explore Experientia</li> <li>Continuous</li> <li>Right under fulfilment of Understand currentscer</li> </ul>	fulfil the above human aspin	nt and ism fo A lool Physic an bein ity corr	process r self-e c at bas cal Faci g with	s; 'Natu xplorati ic Hum lities- tl their co A critica	ral Acco on an Aspi ne basic rrect pri al appra	rations requir iority isal of	e' and ements t	For
II	<ul> <li>Various levels.</li> <li>Understandinghumanbeingasaco-existenceofthesentient 'I' and thematerial 'Body'</li> <li>Understanding the needs of Self ('I') and 'Body' - SukhandSuvidha</li> <li>Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)</li> <li>Understanding the characteristics and activities of 'I' and harmony in'I'</li> <li>Understanding the harmony of I with the Body: Sanyamand Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail</li> <li>Programs to ensure Sanyamand Swasthya-Practice Exercises and Case Studies will be taken up in PracticeSessions.</li> </ul>								r)
III	Understanding value fulfilment to ensure Trust (Vishwas) are Understanding the Difference between Understanding the Between respect are Understanding the	rmony in the family – the batter in human-human relation to the Ubhay-tripti; and Respect (Samman) as the emeaning of Vishwas; in intention and competence meaning of Samman, Different differentiation; the other harmony in the society (sociolar-astitya as comprehensive	nship; found rence salient	meaninational values	ng of Ny values of in relat extension	raya and	l progr onship		

	Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj),
	Universal Order (SarvabhaumVyawastha)- from family to world family! -Practice Exercises and
	Case Studies will be taken up in Practice Sessions.
IV	Understanding the harmony in theNature
	• Interconnectedness and mutual fulfilment among the four orders of nature- recyclability
	and self-regulation innature
	Understanding Existence as Co-existence (Sah-astitva) of mutually interacting
	unitsin all-pervasive space
	Holistic perception of harmony at all levels of existence-Practice Exercises and
	Case Studies will be taken up in PracticeSessions.
V	Natural acceptance of human values
	Definitiveness of Ethical Human Conduct
	Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal
	Order
	Competence in professional ethics:
	Ability to utilize the professional competence for augmenting universal human order
	Ability to identify the scope and characteristics of people-friendly and eco-
	friendly production systems,
	➤ Ability to identify and develop appropriate technologies and management
	patterns for above production systems.
	Case studies of typical holistic technologies, management models and production
	systems
	Strategy for transition from the present state to Universal HumanOrder:
	At the level of individual: as socially and ecologically responsible engineers,
	technologists and managers
	> At the level of society: as mutually enriching institutions and organizations
Guidelines	UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
and Content	PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your goals in
for Practice	your life? How do you differentiate between right and wrong? What have been your
Sessions	achievements and shortcomings in your life? Observe and analyze them.
	Expected outcome: the students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.
	PS 2: Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and
	natural resource depletion, environmental pollution, global warming, ozone depletion,
	deforestation, soil degradation, etc. – all these seem to be man-made problems threatening the
	survival of life on Earth – What is the root cause of these maladies & what is the way out in your
	opinion?
	On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race,
	terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships,
	generation gap, depression & suicidal attempts, etc – what do you think, is the root cause of
	these threats to human happiness and peace – what could be the way out in your opinion?
	Expected outcome: the students start finding that technical education without study of human
	values can generate more problems than solutions. They also start feeling that lack of
	understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living. Any solution
	brought out through fear, temptation or dogma will not be sustainable.
	PS 3:
	1. Observe that each one of us has Natural Acceptance, based on which one can verify
	right or not right for him. Verify this in case of
	i) What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect?
	ii) What is Naturally Acceptable to you – to nurture or to exploit others? Is your living the
	same as your natural acceptance or different?
	2. Out of the three basic requirements for fulfilment of your aspirations- right
	and and a discount in the second short of the

understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

#### Expected outcome:

- 1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
- 2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- 3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!
PS 4: List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.

Expected outcome: the students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too. PS 5:

- 1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary & tasteful→ unnecessary & tasteful→ unnecessary & tasteless →intolerable b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!
- 2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.
- 3. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

#### **Expected outcome:**

- 1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.
- 2. the students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body.
- 3. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

#### PS 6:

- 1. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilisation of the body.
- 2. Find out the plants and shrubs growing in and around your campus. Find out their use

for curing different diseases.

Expected outcome: The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

PS 7: Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:

1a. Do I want to make myself happy? 2a. Do I want to make the other happy?

3a. Does the other want to make him happy? 4a. Does the other want to make me happy? What is the answer?

Intention (Natural Acceptance)

1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy? 3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy? What is the answer?

#### Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention& competence as well as the others' intention & competence.

Expected outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

#### PS 8:

- 1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation.
- 2. Also observe whether your feeling of respect is based on treating the other asyourself or on differentiations based on body, physical facilities or beliefs.

Expected outcome: The students are able to see that respect is right evaluation, and only right evaluation leads to fulfilment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

#### PS 9:

- 1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
- 2. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children

Expected outcome: The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence PS 10: List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders.

Expected outcome: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are alsoable to

see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participation(in terms of nurturing, protection and right utilization) in the nature. PS 11:

- 1.Make a chart for the whole existence. List down different courses of studies andrelate them to different units or levels in the existence.
- 2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are able to make out how these courses can be made appropriate and holistic.

UNIT 5: Implications of the above Holistic Understanding of Harmony at all Levels of Existence PS 12: Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected outcome: The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

#### PS 13:

- 1.Suggest ways in which you can use your knowledge of Technology/Engineering/Management for universal human order, from your family to the world family.
- 2. Suggest one format of humanistic constitution at the level of nation from your side.

Expected outcome: The students are able to grasp the right utilization of their knowledgein their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.

PS 14: The course is going to be over now. Evaluate your state before and after the coursein terms of

a. Thoughtb. Behaviour andc. Workd. Realization

Do you have any plan to participate in the transition of the society after graduating from theinstitute? Write a brief note on it.

Expected outcome: The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for a happy and prosperous society.

## Text book

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values an professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

#### Reference

R1:B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

R2: PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

R3: Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,1991

#### **Other Learning Resources**

- 1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
- 2. Story of Stuff, http://www.storyofstuff.com
- 3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
- 4. Charlie Chaplin, Modern Times, United Artists, USA
- 5. IIT Delhi, Modern Technology the Untold Story

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.	1, 2, 3, 4, 7					
2	It is free from any dogma or value prescriptions.	1, 3, 4					
3	It is a process of self-investigation and self-exploration, and not of giving sermons.	1, 2, 3					
4	Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.	1, 3, 5					
5	This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.	3, 8					

SEMESTER - II										
Course Title	COMMUNICATION MASTERY (Communicative English & Soft Skills)						ls)			
Course code	24UM	PD121R	Total credits: 2	L	T	P	S	R	O/F	С
			Total hours: 60P	0	0	4	0	0	0	2
Pre-requisite	Effe	ective English	Co-requisite				Nil			
programme	Master of Science in Biotechnology									
Semester		Spring/II semester of First year of the programme								
	1.		idents with the transform	nation (	of sent	ences a	nd the	appr	opriate	use of
		<ul><li>prepositions.</li><li>To enhance the writing skills in different areas including CV and cover letter writing</li></ul>								
Course	2.		-			•				riting.
objectives	3.	communication.	ng by reinforcing, subs	tituting	foror (	contradi	cting	verba	I	
	4.		performance boosting a	ctivities	for n	rofessio	nal o	al ac	hieven	nent
CO1			questions, and idioms co			10103510	nai 5	our uc	ine ven	10111.
CO2	_		ent sentence types and							
CO3			hs, precis, and profession		cumen	ts				
CO4	1 1		goal setting, and person							
CO5			nunication and body lar				•			
Unit	mastrati	e non verour comm	Conte		onec					
Unit	I.	Use of Preposit		ent						
Module 1-	II.	Tag questions	10113							
Grammar	III.	Idioms, Phrases	s and Clauses							
Grammar	IV. Simple, complex, compound sentences									
Module 2-	I.									
Grammar	II. Direct and Indirect Speech									
	I. The Basics of Writing; avoid ambiguity and vagueness									
Module 3-	II.	Paragraph Writi	ng							
Writing Skills	III.	Precis Writing								
Willing Skins	IV.	Letter Writing	10 1							
37 11 4	V.	Resume, CV and								
Module 4-	I.	SWOT Analysi Self-Regulation								
Self-	III.	Personal Hygie	•							
Management Skills	111.	i eiseilai iiygie								
SKIIIS	I.	What is Non Va	erbal Communication &	Dody I	00011	200				
Module 5-	II.	Elements of Cor		Body 1	Langua	ige,				
Non- Verbal	III.	Types of Body I								
Communicati	IV. Importance and Impact of Body Language,									
on-Sciences of	V.	_	unication through Body	_	age,					
Body	VI.		Haptic, Introduction to	_	_					
Language	VII.	Introduction to I								
	VIII.		Do's and Don'ts, Doub	t Cleari	ing Se	ssion.				
Module 6-	I.	Importance,	1 01 71							
Group	II. Planning, Elements, and Skills assessed;									
Discussion	III. IV.	Effectively disa	ngreeing, marizing and Attaining	the Ob:	activo					
(Theory)	1 V .	muanig, sumi	manzing and Attaining	աշ ՕԾյ	ecuve					

- 1. Barrett, Grant. 2016.Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- 2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

# Reference books

- 1. Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky,2019
- 2. A Textbook for AECC English Communication: Interface, Dr. KironmoyChetia and PranamiBaniaBreez Mohan Hazarika, January2019.

# **Other Learning Resources:**

- 1. <a href="https://youtu.be/x60GHpQ8gJk">https://youtu.be/x60GHpQ8gJk</a>
- 2. <a href="https://youtu.be/Ke_oSN-BCaY">https://youtu.be/Ke_oSN-BCaY</a>
- 3. https://youtu.be/TDPDtrLxT-c
- 4. <a href="https://www.classcentral.com/report/toefl-preparation/">https://www.classcentral.com/report/toefl-preparation/</a>

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain prepositions, tag questions, and idioms correctly.	5					
2	Discuss and analyze different sentence types and voices.	2, 5					
3	Explain effective paragraphs, precis, and professional documents.	3, 5					
4	Describe SWOT analysis, goal setting, and personal hygiene principles.	5					
5	Illustrate non-verbal communication and body language concepts.	5					

			SEMESTER	Ш						
Course	Course Title Techno-Professional Skills II (Biofertilizer production)									
<b>Course Code</b>		24MSBT215R	Total Credits: 2	L	T	P	S	R	O/F	C
			Total Hours: 60p	0	0	4	0	0	0	2
Pro	e-	Cell Biology,	Co-Requisite	NA						
Requ	isite	Biochemistry					1 1/1			
Progra	ımme		MSc. Bi							
Seme	ester		Fall/ 3 rd Semester of							
Cou			the agronomic importance of tudents learn and formulate b			o-organ	isms			
Objec	tives	3. Produce an	d apply biofertilizers in a pil	ot scale						
CO	1	Explain the Importa	nce of biofertilizers in plant	developi	ment.					
CO	2	Describe mass culti	vation and inoculation.							
CO	3	Explain the importa	nce of Azolla as a biofertiliz	ers.						
CO	4	Describe the import	ance of phosphate in bioferti	lizers.						
CO	5	Apply the knowleds	ge on the use of Fungi and M	ycorrhiz	a.					
Unit			Content			СН		Learning K		
no								outco	me	
I	Biofe	rtilizers- Introduction	on, scope. A general account	of plant		10	Im			
	_	th promoters and regulators – Cyanobacterial Biofertilizer:					biofertilizers in			1,2
	Algal	ization – mass cultiv	vation of cyanobacterial biof	iofertilizers plant development					1,2	
II	Nitro	gen fixing Bacteria: Isolation, characterization, identification,					Kr			
	mass	s cultivation and inoculation method of Rhizobium and					about mass			1,2
		pirillum. Mechanisn				ltivatic		1,2		
	-		y and molecular basis of nitro			10		oculation		
III		Azolla – Structure and Morphology – Mass cultivation method and Application. Economic and Ecological importance of Azolla.						portan zolla	ce of	1,2
IV						10		portan	ce of	
1 1		phate solubilizing Bacteria: Isolation, characterization, ification, mass cultivation and inoculation method of						osphat		
		phobacteria. Biochemistry of Phosphate solubilization and					-	ospiiai		1,2
	_	ization. Carrier base					,			
	application References									
V		_	fertilizers - Introduction, scop	_		10	_	ortano	ce of	
		·	d Arbuscular mycorrhizae (A	,	lation		Fur	-		1,2
			n of Arbuscular mycorrhizae	(AM),			My	corrhi	za	1,2
	Legui	me - AM interaction	NS .							

#### **Text Books**

T1: A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi. Ann Larkin Hansen, 2010,

## **Reference Books**

- R1. Kannaiyan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi.Dubey, R.C. 2001.
- R2. Dubey, R. C. 2008. A Textbook of Biotechnology. S. Chand & Co., New Delhi.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the Importance of biofertilizers in plant development.	1, 2, 9					
2	Describe mass cultivation and inoculation.	1, 2, 3					
3	Explain the importance of Azolla as a biofertilizers.	1, 2, 9					
4	Describe the importance of phosphate in biofertilizers.	1, 2, 9					
5	Apply the knowledge on the use of Fungi and Mycorrhiza.	1,9					

SEMESTER - III										
Course Title		Res	earch E	thics						
<b>Course Code</b>	<b>24UMRE211R</b>	Total Credits:1	L	T	P	S	R	O/F	C	
		Total Hours:60	0	0	0	4	0	0	1	
<b>Pre-Requisite</b>	NA	NA								
Programme	MSc. Biotechnology									
Semester	Fall/ 3 rd Semester of 2 nd year of the program									
Course	1. This course aim	s to lay a foundation for er								
Objectives		ts aware of relevant guidel	_		id cod	les rela	iting to	o ethical r	esearch.	
	3. To make studen	ts learn ethical theories and	d concep	ts.						
CO1	Describe and apply	research ethics theories a	nd metho	ods.						
CO2	Explain research e	thics issues such as respon	sibility, v	vetting,	and n	niscon	duct.			
CO3	Illustrateargument	s and results in ethical rese	arch inqu	uiries.						
CO4	Identify and apply	procedures for sampling,	lata colle	ection, a	nd re	porting	ζ.			
CO5	Apply ethical prine	ciples to research design ar	nd evalua	ition						
Unit no			Conten	t						
I	ETHICS: Introd	uction to the course and ea	ch other	; an inti	oduct	ion to	moral	theory. E	Ethics:	
		philosophy, nature of mor						-		
	self – regulation	research ethics. Honesty,	candor, c	compro	mise a	nd inte	egrity	. Data ow	nership	
	and stewardship; conflicts of interest; collaboration. Human and non-human subjects. Research									
	and researchers in society.									
II	SCIENTIFICCONDUCT- Ethics with respect to science and research. Intellectual honesty									
	and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).									
		cations: duplicate and over	lapping	publicat	tions,	salami	slicir	ig. Selecti	ive	
		srepresentation of data								
III	PUBLICATION ETHICS- Publication ethics: definition, introduction and importance. Best									
	practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of									
	interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributor ship.									
		publication misconduct, co			-			-	and	
	journals.	publication inisconduct, et	mpiami	s and ap	pears	. I Icua	nory p	Juonsners	and	
IV	OPEN ACCESS PUBLISHING-Open access publications and initiatives. SHERPA/RoME0									
1,		o check publisher copyrigh	-							
		y publications developed by			<b>-</b> 1					
		vier Journal Finder, Spring	-			-				
V		MISCONDUCT Group I					ethic	al issues,	FFP,	
		icts of interest. Complaint								
	abroad. Software	tools; Use of plagiarism so	oftware l	ike Turi	nitin,	Urkun	d and	other ope	n-source	
	software tools.									
		AND RESEARCH METE				_				
		of Science, Scopus, etc. Re			-		-		-	
		Report, SNIP, SJR, IPP, C	ite Score	. Metri	es: h-i	ndex,	g inde	x, I 10 inc	dexes,	
	altimetric.									

#### **Text Books**

Bird, A(2006). Philosophy of Science. Routledge.

Macintyre, Alasdair (1967) A Short History of Ethics.London.

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019)

#### Reference Books

National Academy of Science, National Academy of Engineering and Institute of Medicine (2009). On Being a Scientist: A Guide of Responsible Conduct in Research: Third Edition, National academicsPress George R, (2011). Sociological Theory, Rawat Publication, New Delhi, India. George R, (2019). Post Modern Social Theory, Rawat Publication, New Delhi, India.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe and apply research ethics theories and methods.	6					
2	Explain research ethics issues such as responsibility, vetting, and misconduct.	6					
3	Illustratearguments and results in ethical research inquiries.	5, 6					
4	Identify and apply procedures for sampling, data collection, and reporting.	2, 3, 4					
5	Apply ethical principles to research design and evaluation	4, 9					

		SEMESTER -	III						
Course Title		CORPORATI		FICIE	NCY				
		Total Credits: 2	L	T	P	S	R	O/F	C
<b>Course Code</b>	24UMPD211R	Total Hours:60	0	0	4	0	0	0	2
Pre-Requisite	Communication Mastery	Co-Requisite				NA		1	
Programmes	iviastel y	MSc. Bi	otechn	ology					
Semester	I I				he nroc				
Schiester	Fall/ 3 rd Semester of 2 nd year of the program  1. To acquaint students with the various tools of an effective presentation.								
	_				_			ase the	
Course	2. To acquire the speaking skill, instruct, influence, engage, educate, or appease the listeners.								
Objectives	3. To increase proficiency, present ability and quality of resume and provide guidance for								
Objectives	_	and self-evaluation in	_	-		ana pi		B	101
	_	train the students for the			es & wa	ılking ir	ntervie	ws.	
CO1	Able to speak with greate					- 6			
CO3	Discuss the positive impa					ino skil	1s		
CO3	Illustrate with all the nec								
		-			protessi	onai res	sume.		
CO4	Discuss the highlights and				•	• , •		1	
CO5	Explain the impart in ther to crack interviews, impre	•		-				velop stra	itegies
Unit no	or or well miles views, maps		ontent	-,					
I	Module 1- Presentation	n Skills							
_	i. Introduction								
	ii. Essential characterist	ics of a good presentat	ion						
	iii. Preparation of a goo								
II	Module 2- Public Skill	<u> </u>							
	i. Fear of Public Speaking,								
	ii. Understanding and Overcoming Fear of Public Speaking,								
	iii. Confidence and Control,								
	iv. Physiology and Stres	ss - Control/Process,							
	v. Tips for Presentations	s and Public Speaking,							
	vi. Tips for Using Visua	l Aids in Presentation	s,						
	vii. Process for Preparin	-	tations,						
	viii. Delivering Presenta								
	ix. Doubt Clearing and	Summary of Main Po	ints						
III	Module 3- Practical se	ssion on Resume, Cu	rriculu	m Vita	e, Writi	ing cov	er lett	er &	
	LinkedIn Profile	. CD							
	i. Preparation, submission	=							
	ii. Practical session on c		ession						
	iii. Creating a profile on iv. How to utilize it	Linkeum							
	Module 4- Leadership	& Management Skil	lc						
	i. Concepts of Leadershi	_	13						
	ii. Leadership Styles,	φ,							
	iii. Manager VS Leader,								
	iv. How to be an Effecti								
	v. Mock/ Practice Session								
	vi. Doubt Clearing Sess								
IV	Module 5- Research Pa								
	i. How to write a research								
	ii. Key point in Research								
	Module 6- Interview S		hics						
	i. Types of the interview	v- telephonic, virtual &	face to	face					
	ii. Online interview, per	sonal interview,							
	iii. Panel interview,								

	iv. Group interview,					
	v. JAM session,					
	vi. Types of interview questions-traditional/common interview questions,					
	vii. Case interview questions,					
	viii. General Strategies for answering questions,					
	ix. Marketing your skills and experiences,					
	x. Preparation before the interview,					
	xi. How to dress up for an interview,					
	xii. How to maintain eye contact and positive body language,					
	xiii. How to be presentable,					
	xiv. Interview dos and don'ts,					
	xv. Introduction to Dress Code Ethics,					
	xvi. Purpose and Importance					
	xvii. How to Make "FIRSTIMPRESSION"					
	xviii. What to Wear During Interviews or Any Other Formal Meetings – Male &Female					
V	Module 7- Mock Interview					
	i. Practical Mock Interview,					
	ii. Feedback- Receiving Feedback,					
	iii. Giving Feedback,					
	iv. Advantages of Effective Feedback,					
	v. How to deal with negative feedback.					

T1.Barrett,Grant.2016.Perfect English Grammar: TheIndispensable Guide to Excellent Writing and Speaking, Zephyros Press.

T2.McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

# **Reference Books**

Garg. Manoj Kr. (2018) English Communication: Theory and Practice

Other Learning Resources: https://brightlinkprep.com/10-best-toefl-prep-books/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Able to speak with greater control and charisma in front of others.	5				
2	Discuss the positive impact in their thought process and problem-solving skills.	2				
3	Illustrate with all the necessary tools and skill sets to prepare professional resume.	5				
4	Discuss the highlights and assess themselves in social media.	5				
5	Explain the impart in them techniques to solve critical problems in an interview, develop strategies to crack interviews, improve their communication skills, boost their confidence	5, 6, 8				

SEMESTER - III									
<b>Course Title</b>	MINI RESEARCH (SURVEY/EXPERIMENTS-R3)								
Course code	24MSBT217R	<b>Total credits: 2</b>	L T P S R O/F C			C			
		Total hours: 60P	0	0	0	4	6	0	2
Pre-requisite	Nil	Co-requisite	Nil						
Programmes		Master of So	cience	in Bio	techno	logy			
Semester	Spring/II Semester of First Year of the Programme								
Course	To develop stude	ents scientific method							
objectives									
CO1	To design an exp	eriment using scientifi	c meth	od.					
CO2	Apply the knowl	edge of sampling meth	ods in	sampl	e colle	ction.			
CO3	To store and wor	k on the sample throug	gh vario	ous par	rametri	c assay	ys.		
CO4	To structurize da	ta and perform statistic	al ana	lyses.					
CO5	To interpret and	discuss the findings.							

	S	SEMESTER - III							
Course Title	Pl	ERSONALFINAN	CIAL	PLAN	NING	r			
Course Code	24UUFL202R	TotalCredits:1	L	T	P	S	R	O/F	C
Course Coue	24UUFL2U2K	TotalHours:30p	0	0	2	0	0	0	1
	Introduction to					I	ı		
Pre- Requisite	Financial Budgeting Co-Requisite NIL								
•	And Planning								
Programmes	Master of Science in Biotechnology								
Semester	Fall/	3 rd Semester of 2 nd	year	of the	progr	am			
	1. The course would offer an						oncept	ts of mo	ney,
	borrowing, lending, taxes ar	, lending, taxes and their application to financial planning.							
Course	2. Assess the personal finan-	cial planning process,	the lif	e cycle	of fina	ncial p	olans, a	and meth	ods
<b>Objectives</b>	of goal achievement.								
	3. Formulate a budget, recor	d-keeping system, an	d tax p	lannin	g strateg	gy bas	ed on o	current	
	financial goals.								
CO1	Explain the cash manageme					les.			
CO2	Discuss a diversified investr	nent portfolio for diff	erent o	bjectiv	ves.				
CO3	Compare mutual funds, ETI	s, and real estate inve	estmen	t optio	ns.				
CO4	Develop a financial plan for	retirement and estate	protec	tion.					
CO5	Describe financial products	and strategies for lon	g-term	goals					
Unit no		Cont	ent						
	Unit 1- Fundamentals of F	inancial Planning –							
	i. Functions of money;								
	ii. Inflation- Meaning, causes, how it can be controlled;								
I	iii. process official planning								
-	iv. Time value of money-simple and compound interest;								
	v. Net Present Value and Future value,								
	vi. Power of Compounding;								
	vii. Doubling period and Rule of 72.								
	Unit 2- Income Tax Planning—								
	i. Meaning of Income, ii. Direct & Indirect Taxes, Taxable Income, various heads of Income for tax Calculation,								
II	iii. Non-taxable Income,								
	iv. Tax evasion and tax avoidance,								
	v. GST, Tax Planning Strategies.								
	Unit 3- Entrepreneurial pl	anning –							
	i. Meaning of Entrepreneurship, prerequisites for becoming an entrepreneur,								
	ii. Entrepreneurship Suppor	•							
III	iii. Institutional support systems for entrepreneurs,								
	iv. Financial support system	_							
	v. Venture Capital, Business								
	vi. Assistant of Government								
	vii. Commercial Bank Loan		14						
	Unit 4-Planning for investi i. Investment avenues offere	~		mary N	Market o	and Sa	conda	ry Mark	>t
	ii. Stock market- meaning, f	-		-				-	٠ι,
	iii. Security repository, stock					_			of
***	orders, contract note, pay-in	-	-				Pr		
IV	iv. Various risks involved in				-		al Inte	rmediari	es;
	Stock indices.	Č							-
	v. Mutual Funds- meaning c	oncept, definition, ty	pes, im	portan	ce and o	drawba	acks of	f mutual	
	funds, mutual funds in India	, investing in mutual	funds,						
	vi. Systematic Investment P	lan (SIP) and its adva	ntages.	·					
V	<b>Unit 5- Planning for debts</b>	and Retirement							

i. Consumer credit - Introduction to consumer credit; choosing a source of credit, the cost of
credit alternatives,
ii. Consumer Legal Protection;
iii. Housing Decision: Factors and Finance; Vehicle Decisions.
iv. Retirement planning - Meaning of cost of living; retirement need analysis; development of
retirement plan, various retirement schemes,
v. Estate Planning; Pension and Medicare Planning; Wills.

- 1. Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million-Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by David J. Mullen Jr
- 2. Personal Finance and Planning by Dr. Rajni
- 3. Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh
- 4. Be Your Own Financial Advisor: Financial Planning, Investment Options, Risk Management, Tax Management, Succession Planning Kindle Edition y Sushil Bali
- 5. The Dumb Things Smart People Do with Their Money: Thirteen Ways to Right Your Financial Wrongs Kindle Edition y Jill Schlesinger

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the cash management and buying plan for homes or automobiles.	5					
2	Discuss a diversified investment portfolio for different objectives.	9					
3	Compare mutual funds, ETFs, and real estate investment options.	2, 5, 9					
4	Develop a financial plan for retirement and estate protection.	9					
5	Describe financial products and strategies for long-term goals	5					

		SEMESTER	- III						
<b>Course Title</b>		Plant and An	imal	Biote	chnol	ogy			
<b>Course Code</b>	24MSBT211R	Total Credits: 4Total	L	T	P	S	R	O/F	С
		Hours: 45t+30p	3	0	2	0	0	0	4
<b>Pre-Requisite</b>	Cell Biology,	Co-Requisite		1		N	A		
-	Biochemistry,	•							
	Molecular								
	Biology								
Programme		MSc. B	iotec	hnolo	gy				
Semester		Fall/ 3 rd Semester o				progra	m		
	1. Introduction	on to the best use of Plant C		•				ntenance	of aseptic
	condition.								
	2. To describ	e the plant cell, its characte	ristic	organe	lles as	s well as	the co	mpositio	n, structure
Course		rties of the plant cell wall, a							
<b>Objectives</b>		on to the best use of Anima	Cell	Cultur	e med	ia as wel	l as m	aintenan	ce of
	aseptic con								
		n of various cell to cell inte	ractio	n; adh	esion,	motility	and m	etabolic	co-
CO1	operation.	ed genetic modification tec	mian	25 11526	lin ho	th plants	and a	nimala	
CO1	_	ed genetic modification technistrate the skills in plant and							antina
CO2	methods.	istrate the skins in plant and	amm	iai tissi	ie cui	ture, cioi	iing, a	па ргора	igation
CO3		edge of biotechnology to en	hance	e cron	vield	improve	resist	ance to r	ests and
CO3		ize agricultural practices.	mane	ССГОР	y icia,	mprove	105150	unee to p	esis una
CO4	-	dge of biotechnology in me	dicine	e and h	ealthc	are, part	icularl	y in the	context of
	animal biotechnolo					, 1			
CO5		issues related to plant and a	nimal	l biotec	hnolo	gy.			
Unit No							KL		
						0	utcor	ne	
I	Cell and tissue cu	lture: Introduction to cell a	nd			To lea	rn the	basics	1,2
	Tissue Culture La	aboratory facilities, Tissue				of plan	nt tissu	ie	
	1	mposition and preparation)		10	)	culture	e		
	_	nsion cultures: initiation and		10					
		allus and suspension culture	es;						
TT	single cell clones	propagation, regeneration,				To har		daga	1.2
II	1	propagation, regeneration, bloids, protoplast culture an	. l			on em			1,2
		ation. Cloning in plants - Ti		8		and or			
	bolliatio il joliale						541105		
	plasmid organiza	<u> </u>							
		tion. Concept of transgenic and other plant applications.							
III	plants Bt cotton a	tion. Concept of transgenic				To get	the ba		1,2
III	plants Bt cotton a Various techniqu culture: Culture r	tion. Concept of transgenic and other plant applications. es of animal cell and tissue nedia, growth factors,				To get	edge o	asic	1,2
III	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti	tion. Concept of transgenic and other plant applications. es of animal cell and tissue nedia, growth factors, es. Characteristics of cells in				To get knowl differe	edge o	asic on the	1,2
III	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i	tion. Concept of transgenic and other plant applications, es of animal cell and tissue nedia, growth factors, es. Characteristics of cells in hibition, anchorage	n			To get knowl differentechnic	edge o ent ques o	asic on the	1,2
III	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell-	tion. Concept of transgenic and other plant applications. es of animal cell and tissue nedia, growth factors, es. Characteristics of cells in hibition, anchorage cell communication etc.; C	n ell	8		To get knowl differe	edge o ent ques o	asic on the	1,2
III	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a	tion. Concept of transgenic and other plant applications, es of animal cell and tissue media, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph	n ell			To get knowl differentechnic	edge o ent ques o	asic on the	1,2
III	plants Bt cotton a  Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary o	tion. Concept of transgenic and other plant applications, es of animal cell and tissue nedia, growth factors, es. Characteristics of cells in hibition, anchorage cell communication etc.; C and tissue response to troph culture, immortal cells, cell	n ell			To get knowl differentechnic	edge o ent ques o	asic on the	1,2
III	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary o lines. d) Mainten	tion. Concept of transgenic and other plant applications, es of animal cell and tissue media, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph	n ell			To get knowl differentechnic	edge o ent ques o	asic on the	1,2
	plants Bt cotton at Various technique culture: Culture relaboratory facilities culture: Contact is dependence, cell-senescence; cell at factors. Primary cellines. d) Maintena laboratory.	tion. Concept of transgenic and other plant applications, es of animal cell and tissue media, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph culture, immortal cells, cell ance of cell lines in the	n ell ic			To get knowl different technic anima	edge o ent ques o l cell c	asic on the	
IV	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary o lines. d) Maintena laboratory. rDNA products: l	tion. Concept of transgenic and other plant applications, es of animal cell and tissue nedia, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; Cond tissue response to troph culture, immortal cells, cell ance of cell lines in the	n ell ic			To get knowl different technicanima	edge of the sent o	asic on the f culture	1,2
	plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary o lines. d) Mainten- laboratory.  rDNA products: l DNA products in	tion. Concept of transgenic and other plant applications, es of animal cell and tissue media, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph culture, immortal cells, cell ance of cell lines in the	n ell ic	8	:	To get knowl different technic anima	edge of the sent o	asic on the f culture	
	plants Bt cotton at Various technique culture: Culture relaboratory faciliticulture: Contact is dependence, cell-senescence; cell afactors. Primary cellines. d) Maintens laboratory.  rDNA products: In DNA products in somatostatin, vac	tion. Concept of transgenic and other plant applications, es of animal cell and tissue nedia, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph culture, immortal cells, cell ance of cell lines in the	n ell ic		:	To get knowl different technicanima.  To apple knowl	edge o	asic on the f culture	
	plants Bt cotton at Various technique culture: Culture relaboratory facilities culture: Contact is dependence, cell-senescence; cell at factors. Primary cellines. d) Maintens laboratory.  rDNA products: In DNA products: In Somatostatin, vace therapy, Production hepatitis. Concept	tion. Concept of transgenic and other plant applications, es of animal cell and tissue media, growth factors, es. Characteristics of cells inhibition, anchorage cell communication etc.; C and tissue response to troph culture, immortal cells, cell ance of cell lines in the Brief idea about recombinate medicine (insulin, cines), Concept of Gene	n ell ic	8	:	To get knowl different technicanima  To app knowl DNA	edge of the control o	asic on the  f culture	

	humans and farm animals. Transgenic animals			
V	PR proteins, nematode resistance, marker-	PR proteins, nematode resistance, marker-		1,2,3,4
	assisted selection – strategies for introducing		applications of	
	genes of biotic and abiotic stress resistance in	9	biotechnology in	
	plants. Ethical issues of plant and animal		the field of plant	
	biotechnology		science	
Practical	Establishing a plant cell culture (both in solid		To apply the	1,2,3,4
	and liquid media) – seed germination, callus		practical	
	culture, suspension cell culture, regeneration		knowledge of	
	from callus cells. Cell count by	30	plant	
	hemocytometer. Artificial seed.		biotechnology in	
			various fields	

1.Biotechnology by U. Satyanarayan.

2.Biotechnology; Expanding Horizon by B.D. Singh.

3.Biotechnology; S.S.Purohit

# Reference Books

Ravishankar G.A. and Venkataraman L.V. (197) Biotechnology Applications of plant

Tissue & culture. Oxford & IBH Publishing Co, Pvt. Ltd.

Bhan (1998) Tissue Culture, Mittal Publications, New Delhi.

Islan A.C (1996) Plant Tissue Culture, Oxford & IBH Publishing Co. Pvt. Ltd.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain the advanced genetic modification techniques used in both plants and animals.	1, 2, 3				
2	Acquire and demonstrate the skills in plant and animal tissue culture, cloning, and propagation methods.	1, 2, 3, 4				
3	Describe the knowledge of biotechnology to enhance crop yield, improve resistance to pests and diseases, and optimize agricultural practices.	1, 2, 3				
4	Discuss the knowledge of biotechnology in medicine and healthcare, particularly in the context of animal biotechnology.	1, 2, 7				
5	Explain the ethical issues related to plant and animal biotechnology.	1, 2, 7				

Course Title Medical Biotechnology  Course Code 24MSBT212R Total Credits: 4 L T P S R C Total Hours:45T+30p 3 0 2 0 0	O/F 0	C					
Total Hauss 45T+20p		C					
Total Hauss 45T+30p		_					
		4					
Pre-Requisite Molecular Co-Requisite NA		-					
biology							
Programmes MSc. Biotechnology							
Semester Fall/ 3 rd Semester of 2 nd year of the program							
1. To introduce the students about human genome project, concept of gene to	therar	v. stems					
Course cells and various diseases.	inerap	y, scenis					
Objectives 2. To study the detail about diagnosis, treatment, control measurement of variables.	arious	diseases.					
3. To study Nano biotechnology and its application in drug delivery.							
CO1 Explain Human Genome Project and its importance in the field medical science.							
CO2 Discuss gene therapy focusing on disease-associated genes and ethical consideration	ion						
contributions to this field addressing genetic diseases.							
CO3 Describe the concept of stem cells and its properties.							
CO4 Describe Cancer Biology, explores and demonstrate microbial diseases, providing	insig	hts into					
infection modes, control measures for a holistic view of human health.	5						
CO5 Illustrate the concept of nano materials, their synthesis, and applications in biosens	isors, o	drug					
delivery, gene therapy, and cancer therapy.	,	8					
Unit no Content CH Learning outcom	ne	KL					
Human genome Project-Introduction, 10 To learn the basics as		1,2					
I history, techniques, ethics, application. scopes of medical		-,-					
biotechnology							
Gene therapy- Introduction, genes 8 To harness ideas on		1,2					
responsible for disease, Principle, types, recent trends in the							
II gene targeted for gene therapy, SCID, field of medical							
Humanized antibody, plasminogen biotechnology							
activator, ethics, importance							
Stem Cells: Introduction, Types of Stem 8 To get the basic		1,2					
III Cells, Sources of Stem Cells Properties of knowledge of stem co	ell						
Stem Cells therapy							
Cancer Biology: Introduction, Types of 10 To learn about cancer		1,2,					
Tumours, Predisposing factors for cancer, diagnosis and therapi	ies						
Cellular changes involved in Tumour related to it.							
formation, Methods of Tumour detection,							
Treatment of cancer – Chemotherapy and							
Radiotherapy. Microbial diseases in Human							
- mode of infection, symptoms,							
epidemiology and control measures  Nanobiotechnology- introduction, Type of 9 To learn about the		1 2 2 4					
nano material, Synthesis of nano material, techniques for the		1,2,3,4					
Nano Biosensor, Drug Delivery, Gene detection of different	, l						
therany Drug Delivery Cancer Therany diseases							
V Risk Potential of Nano Material. Molecular							
detection of presymptomatic genetic							
disease, its importance in health care, pre-							
natal diagnosis and genetic manipulation							
Practical Study of Mycobacterium tuberculosis by 30 To apply the practical	al	1,2,3,4					
AFB staining method. Diagnosis of venereal knowledge of detections		, ,-, -					
disease by using VDRL test. Study of of different diseases							
Salmonella typhi by using Widal test							

T1: Medical Biotechnology, V. Rao p. Nallari, Oxford University Press

## **Reference Books**

- R1: Human Molecular Genetics 2nd Edition by Strachan & Read, Wiley and sons' publication.
- R2: Medical Microbiology, Credic A Mims (2004) 3rd Edition, Mosgy Inc. Publication
- R3: Nano biotechnology, Subbiah Balaji, Neha Publishers & Distributors
- R4: Nano biotechnology: Concepts, Applications & Perspectives, Niemeyer C M, Wiley India Pvt. Ltd.-New Delhi.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain Human Genome Project and its importance in the field medical science.	1, 2, 4, 6				
2	Discuss gene therapy focusing on disease-associated genes and ethical consideration contributions to this field addressing genetic diseases.	1, 2, 3, 5				
3	Describe the concept of stem cells and its properties.	1, 2				
4	Describe Cancer Biology, explores and demonstrate microbial diseases, providing insights into infection modes, control measures for a holistic view of human health.	1, 2, 3, 4				
5	Illustrate the concept of nano materials, their synthesis, and applications in biosensors, drug delivery, gene therapy, and cancer therapy.	1, 2, 3, 4				

		SEMESTER - II	Ι						
Course Title		<b>Bioprocess and Fern</b>	ientat	ion T	Techno	ology			
<b>Course Code</b>	24MSBT213R	Total Credits: 4	L	T	P	S	R	O/F	C
		Total Hours: 45T+30P	3	0	2	0	0	0	4
<b>Pre-Requisite</b>		CO-REQUISITE				N.	A		
	Biology,								
-	Microbiology	150 81							
Programme		MSc. Biot							
Semester		Fall/ 3 rd Semester of 2							
	l .	train improvement technique	es, inoc	culation	on proc	edures	s, media	n prepar	ration,
Course	types and make up of			_					
Objectives		trial production of Agar, Alc	ohols,	Orgai	nic Aci	ds, An	nino Ac	ids, An	tibiotics,
•	SCP, Vitamins, Enzy								
601	_	lge on upstream and downstr						1 11	
CO1		al development in Bioproces	s Engir	neerin	ıg, key	ınvent	ions and	d disco	veries and
CO2	its application in diff	erent fields. ructure, function, and operati	ion of l	ni or oc	otora i	naludii	ag fund	tional a	narations
CO2	_	tion in designs of bioreactors		010162	iciois i	nciuan	ig, runc	zuonai c	perations
CO3	_	tion strategies of fermentation		ia and	l differ	ent soi	irce of r	nutrient	s for
	fermentation media.	non strategies of fermematic	ii iiiou	ia arre		ciii soc			5 101
CO4		es of downstream processing	and di	fferer	nt isola	tion an	d purifi	cation	methods
	of biotechnological p						1		
CO5	Summarize the differ	ent fermentation processes in	nvolve	d in f	erment	ed foo	ds and I	HACCF	concept
	and explain effective	safety measures in producin	g ferm	ented	foods.				
Unit no	Content		CH	]	Learn	ing ou	ıtcome	e	KL
		E, History, application,	7		By the e				1, 2
	_	on for bacterial and fungal					nts will	I	
	-	selection and strain		understand Bioprocess					
_	improvement				_		BPE), it		
I					-		ations, a inoculu		
							l strain	J111	
					mprove				
					nicrobi				
	Bioreactors: Introd	uction, basic design,	10				oproces	SS	1,2
	l .	struct, Temperature		E	Inginee	ering (I	BPE), it	s	·
		affles, Agitation systems			-		ations,		
II		nentor, air supply and			_		inoculu		
	•	noculation and sampling		-			d strain		
	_	ed bioreactor, Fluidized			mprove				
	bed bioreactor, pac	ked bed bioreactors, Photo		n	nicrobi	ai proc	esses.		
		on media, natural and	8	1	Inderst	and fe	rmentat	ion	1,2
	synthetic media, M	•	0				ng natu		1,2
		of Carbon, Nitrogen,			nd syn		-	141	
	•	, Buffers, Precursor,			nedia f				
		Antifoam agents, Solid		S	trategie	es, and	the		
111	state fermentation.			s	ources	and ro	les of		
Ш				С	arbon,	nitroge	en,		
					itamin				
					uffers,				
					nhibito				
					ntifoar				
				S	olid-sta	ate ferr	nentatio	on.	

IV	Downstream process: Introduction, Objective, criteria, cell disruption, precipitation, filtration, Centrifugation, Liquid-Liquid extraction, Membrane filtration, Chromatography, Drying device, Crystallization, Packing and Quality assurance. Immobilization: Definition, concept, Process of immobilization, Enzyme and whole cell immobilization, application, Food spoilage: Introduction, types, spoilage due to bacteria, fungi, yeast, food processing	12	Understand downstream processing, immobilization techniques, and the causes and prevention of food spoilage, along with food processing methods like canning, packing, sterilization, and pasteurization.	1,2
	principle, methods, Canning, Packing, Sterilization, Pasteurization			
V	Fermented food: Sausages, olives, Bread, Idli, Acidophilus milk, importance of fermented food, HACCP concept	8	Understand the fermentation processes in sausages, olives, bread, idli, and acidophilus milk, and the importance of fermented foods, including HACCP for food safety.	1,2
Practical	Production of acetic acid, citric acid, lactic acid	30		1,2,3,4

T1: Stanbury, P. F, Whitaker, A and Hal. S. J(1997), Principle of fermentation technology-Elsevier Science Limited, Aditya Book(P) ltd, New Delhi.

T2: Crueger&Crueger (2004) Industrial Microbiology. 3rd edition.Panima Books, New Delhi

# **Reference Books**

- R1: Prescott and Dunn (1984), Industrial Microbiology, Mc Graw Hill New York.
- R2: Casida Jr L.E(1997), Industrial Microbiology, New Age International Pvt Ltd.
- R3: Fraiser W.C and West off D.C(1998) Food Microbiology, Tata Mc Graw Hill Publication, New Delhi
- R4:Mc NeilBand Harvey I.M. (1990) Fermantation, a practical approach. IRL Press, New York
- R5: Doyle, MP et al, Food microbiology, ASM Press, Washington D.C.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the historical development in Bioprocess Engineering, key inventions and discoveries and its application in different fields.	1, 2
2	Explain the design structure, function, and operation of bioreactors including, functional operations and specialised variation in designs of bioreactors.	1, 2, 3
3	Illustrate the formulation strategies of fermentation media and different source of nutrients for fermentation media.	1, 2
4	Outline the techniques of downstream processing and different isolation and purification methods of biotechnological products.	1, 2
5	Summarize the different fermentation processes involved in fermented foods and HACCP concept and explain effective safety measures in producing fermented foods.	1, 2, 3, 9

		SEMESTER	- III							
<b>Course Title</b>		FOOD BIO	TEC	CHNO	LOG	Y				
<b>Course Code</b>	24MSBT214R	<b>Total Credits: 4</b>		L	T	P	S	R	O/F	С
		Total Hours:45p+30	)p	3	0	2	0	0	0	4
<b>Pre-Requisite</b>	Molecular	Co-Requisite				1	NA			
	biology,									
	microbiology									
Programmes		MSc. I			~					
Semester		Fall/ 3 rd Semester of	of 2 nd	year	of the	progr	am			
		applications and current				_				
Course		on advantages and limita	tions o	of nov	el food	l produc	ts obta	ined t	hrough	1
Objectives	_	gical approaches.	J	6	41	1 4			.C 4	:c
ŭ		le of microorganisms and ost recent advances in fo	-		-					
CO1		ciples of fermentation.	ous III	auc 01	WILLI E	genetica	ny mo	arrica	organi	.51115.
CO2	Describe selected ferr									
CO2		m of enzyme action and	classit	ficatio	n.					
CO4		nk food chemistry with i								
CO5	1	ship skills related to food			ogv.					
Unit no		ntent		СН		Learn	inσ Διι	tcom	16	KL
I	Food biotechnology			3		lerstand				1,2
_	historical developme			5		historic				1,2
						ood bio		_		
II	_	ional quality of foods-	1	10	Lea	rn meth	ods to	enhar	ice	1,2
	manipulation of suci					nutritio	•	•		
	content: manipulatio	-				ds throu	_	•	tion	
	composition of oils,	enriching with protein				ucrose,		-		
	methionine and lysis					ls, prote erals, a				
	1	he levels of vitamins				crais, a	ia umi	no uci	us.	
	and minerals.									
III	Removal or minimiz	ring the anti-nutritional	1	12	Gai	n know	ledge o	f		1,2
	factors and toxic mo				- 1	niques				
	phytate, oxalic acids					imize a				
	decreasing the conte	_			- 1	ors, tox				
	herbicides and heavy insecticides, develop					oicides, n food.	and ne	avy n	ietais	
	resistant plant etc.	ment of herbicide			1101	11 100 <b>u</b> .				
IV	Increasing the shelf	life of the fruits	1	12	Exp	lore me	thods t	o inci	ease	1,2
	_	d value, metabolites-			_	shelf lif				'-
		avors, food additives,				abolites				
		nal biotechnology for				ors, Flav		lditive	es,	
	increasing meat qua	ity and meet			and	sweete	ners.			
V	production.  Probiotics in foods:	mathods of		0	T Ten	lerstand	onim-	1		1.2
V	incorporation and ty			8		erstand echnolo			ovina	1,2
	incorporation and ty	pes of problemes				ecilloid it qualit		_	_	
Practical	Isolation of probiotic	es microorganisms	3	30		rn abou				1,2,
	from different sourc	_				ds, inclu	-			3,4
						orporati		types	of	ĺ
					pro	biotics ı	ised			

T1: Food Biotechnology - 2nd Edition - Martin Wiedmann

# **Reference Books**

R1: Bio enhancement and Fortification of Foods for a Healthy Diet. Octavio Paredes-López, Oleksandr Shevchenko, Viktor Stabnikov, Volodymyr Ivanov. August 08, 2022

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain the basic principles of fermentation.	1
2	Describe selected fermentation systems.	1, 2
3	Discuss the mechanism of enzyme action and classification.	1, 2
4	Develop the skill to link food chemistry with industry.	1, 3
5	Develop entrepreneurship skills related to food biotechnology.	1, 2, 3, 9

		SEMESTE	R - III						
<b>Course Title</b>		MINI RESEARCH (	SURVE	Y/EXI	PERIM	ENTS	-R4)		
Course code	24MSBT224R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours: 30P	0	0	0	4	6	0	2
<b>Pre-requisite</b>	Nil	Co-requisite				N	il		
Programmes		Master of Sc	ience i	n Biot	echnol	ogy			
Semester		Spring/II Semester o	f First	Year	of the	Progra	amme		
Course	To develop students	s' scientific method							
objectives									
CO1	To design an experi	ment using scientific met	hod						
CO2	Apply the knowleds	ge of sampling methods in	n sampl	e collec	ction.				
CO3	To store and work of	on the sample through var	ious pa	rametri	c assay	S.			
CO4	To structurize data a	and perform statistical an	alyses.						
CO5	To interpret and dis-	cuss the findings.							

		SEMESTER 1	IV						
<b>Course Title</b>		ORGANI	C FAR	MING					
Course code	24MSBT221R	Total credits: 4	L	T	P	S	R	O/F	С
		Total hours:45T+30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite		1	I	Nil			
Programme		Master of Science	ce in B	Biotech	nology	7			
Semester		Spring/I							
	1. Introduction	to Concept of Organic cultiv	vation						
Course	2. To discuss th	e Organic Farming System	(OFS),	its imp	ortance	and bei	nefits.		
objectives		e methods associated with o	rganic	farmin	g – mulo	ching, c	rop ro	tation,	tillage,
	bio-fertilizer								
		ing, its principles, scope and							
( ( ) )		between organic farming and		-			ıtrient	cycles,	soil
p ₁		e of crop varieties, planting					1 .	CC .:	
( ( ) )		on methods, analyse scenarion in pest and weed manageme		ose stra	ategies a	ind eva	iuate e	riective	eness,
		roduction of rice, zinzer, turn		202020	and vac	otobles			
		of soil less farming system.	incric, t	Janana	and veg	ctables	•		
Unit-No.	•	ontent	C	п	Lac	arning	Outo	omo	KL
	Introduction to Org		C	11		stand o			KL
	_	Principles and Types of				ng, its t	_	,	
	•	ming; Need and Benefits	1	0		ples, be	_	and	1,2
		Farming (CF) Vs (OF);	_		scope.				-,-
	Scope of OF.				•				
		d Soil tillage, Choice of			Descr	ibe illus	strate a	and	
		agation – Seed, planting			_	n the o	_		
		atments, Crop rotation,			farmir	ng syste	m		
		Management, Green	8	3					1,2
	Manuring, Mulching								
	Vermicomposting, C Biofertilizer	organic Manure,							
		ultural and Mechanical			Descr	ibe and	expla	in the	
	method; Biopesticid		_			is ways	-	iii tiic	
	Pesticides, Bio-contr		8	3		ting pla			1,2
	Management				•				
IV	Organic crop produ	action of Rice, Zinzer,			Descr	ibe and	expla	in the	
		nd Vegetables Yolk-its	1	0	_	_	action	of crop	1,2
	function and signific				plants				
	Concept on modern			,		ibe and	-		1.2
	methods – Hydropo	nics, Aquaponics,	9	,		n meth	ods of		1,2
	Hydroponics	manure/ compost using			agricu	knowl	edge o	·f	
Practical	<ol> <li>Prepare organic given substrates.</li> </ol>					ic farmi	_	71	
.	-	nd identify microbes			organi	1011111	g		1,2,
		ed as a biofertilizer.	30	0					3,4
	3. Apply any organ								
1		se their potentiality							1

# Text books

T1. J. M. Fortier. The Market Gardener – A successful Grower's Handbook for Small- Scale OF. 1st edition. New Society Publishers, 2014.

# Reference books

- R1. A. L. Hansen. Organic Farming Manual: A Comprehensive Guide To Starting And Running A Certified Organic Farm. 1st edition. Storey Publishing LLC, 2010.
- R2. C. SarathChandran et al. Organic Farming: New Advances Towards Sustainable Agriculture Systems, 1st edition, Springer; 2019.
- R3. D. Nandwani (eds). Organic Farming for Sustainable Agriculture.1st edition, Springer; 2016.

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain organic Farming, its principles, scope and benefits for the health and society.	1					
2	Illustrate the relation between organic farming and natural processes such as nutrient cycles, soil preparation and choice of crop varieties, planting material and seed treatment.	1, 2					
3	Discuss crop protection methods, analyse scenarios, propose strategies and evaluate effectiveness, preparing to innovate in pest and weed management.	2, 3					
4	Explain the organic production of rice, zinzer, turmeric, banana and vegetables.	1					
5	Describe the concept of soil less farming system.	1					

		SEMESTER	- IV						
<b>Course Title</b>		Environmen	ntal Bi	otechn	ology				
Course code	24MSBT222R	Total credits: 4	L	T	P	S	R	O/F	С
		Total hours:45T+30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite				Nil		I	1
Programme		Master of Scie	nce in	Biotec	hnolog	y			
Semester		Spring							
	1. The course aims	to provide an advanced und				cts of cl	imate	change,	
		vironmental management, p	pollutic	on and co	ontrol, p	opulati	on dyr	namics,	
	ecosystems and urb								
Course	-	nnology and human actions		-	_		-		1.1
objectives	_ ·	aral resources. The study of				helps 1	o enlig	ghten the	world
J	_	, such as forest denudation	-		_	amler een	to a	alera +1aa	
		edge gained through environe e environment can be prese				•	•		
	F	ment from destruction and			-				ecessary
CO1		cept of climate changes and				JIII CAU	iletion.		
CO2		y and their conservation.	u tileii .	managei	iiciit.				
	-	ternative fuels and their pro	duatio	<b>.</b>					
CO3					1	1:1.:	:		,
CO4		piodiversity and its role in bets to terrestrial ecosystem f	_		cycles,	linking	micro	organisi	ns eco-
CO5		ental problems and solution		1.					
Unit-No.	Content	entar prooferns and solution		СН	T a	aunin	. Out	2022	KL
1		ion, Renewable and non-		СП		arning unders			KL
1		resources and maintenance	e	6		sics of r			1,2
	Tenewable energy	, resources and maintenance		O		ergy	ciic wa	oic .	1,2
2	Pollution- Introdu	ction, sources and					bout p	ollution	
_		oil, air and water pollution,				d water	_		
	_	rtant natural resources,							
	Importance of wa	ter management, waste wat	er						
		atment, Aerobic process-							
	_	method, Oxidation ditch,							
	-	xidation pond Anaerobic		6					1,2
	_	bic filter, Membrane							
		nent of dairy effluents,							
		lery effluents, treatment of treatment of textile effluent							
		industry effluents, CEPT,	15,						
	reverse osmosis a	-							
		- xenobiotic compounds and	d		То	learn a	bout		
3	_	emediation-concept and			bio	magnif	icatior	ı,	
-	principle, bioreme	ediation of xenobiotics, soil	,		ph	ytoreme	diatio	n	
	water contaminate	ed with hydrocarbon and							
		nining, Bioleaching,		6					1,2
	_	ioaccumulation of heavy		O					1,2
		oring (Bio indicators),							
	1 -	Biofilm, Organ chloride							
	_	each plant effluents							
	(Reduction)	gamanti intraduction		6	Т-	learn a	hout		
4		gement: introduction, nent, waste as a source of		O		learn a			
4	_	on of plant fibre, cell wall,				vironme			1,2
		wood and pitch problem,				otechno			1,2
		and fuel from wood waste.					0)		

	Biotechnological approach to solve slime problem.			
5	Biogas production- methanol production and byproducts of sugar industry, composting and wormiculture, Global environmental Problems-Ozone depletion, its impact on the environment, Greenhouse effect, acid rain. Biodiversity-Status and conversation, biotechnological approach in conservation of biodiversity, GMO and its impact on the environment.	5	To learn about applications of environmental biotechnology	1,2
Practical	Extraction of enzymes from waste using microbial cultures, Visit to industrial wastewater treatment plants	30	To apply the knowledge of environmental biotechnology	1,2, 3,4

# **Text books**

T1: Environmental biotechnology, Kumar, Arvind, 2004

# Reference books

R1: Introduction to Environmental Biotechnology A.K.Chatterji, 2007

R2: Introduction to Environmental Science & Technology Dr. S. Amal Raj, First Edition, 2005

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Discuss the concept of climate changes and their management.	1
2	Explain biodiversity and their conservation.	2
3	Illustrate various alternative fuels and their production.	3
4	Discuss microbial biodiversity and its role in biogeochemical	4
	cycles, linking micro-organisms eco-physiological aspects to	
	terrestrial ecosystem function.	
5	Describe environmental problems and solutions.	5, 4

Course code   24MSBT223R	O/F C 0 4
Course code   24MSBT223R	0 4
Pre-requisite Nil Co-requisite Nil Programme Master of Science in Biotechnology Semester  Spring/IV Semester  1 To introduce the students about Bio pesticides Biofertilizersets	
Programme Master of Science in Biotechnology  Semester Spring/IV Semester  1 To introduce the students about Bio pesticides Biofertilizersets	tables
Semester Spring/IV Semester  1 To introduce the students about Bio pesticides Biofertilizersets	tables
1 To introduce the students about Rio pesticides Riofertilizerseto	tables
1. To introduce the students about Bio pesticides, Biofertilizersetc.	tables
	tables
objectives  2. To studypost-harvest modification and stress management by plants.  3. To study the detail about seed certification process.	toblog
CO1 Explain and apply the concept of Bio pesticides, biofertilizers to get better yield.	toblog
CO2 Describe the concept of Post harvest modification to maximize the storage of food/vege	labies.
CO3 Explain the various steps involve in seed certification.	
Discuss the principles and techniques of genetic engineering used to enhance abiotic str	ess
tolerance in plants and to induce male sterility.	
CO5 Illustrate the potential applications of biotechnology in agriculture, including genetic mo	dification,
crop improvement, and sustainable farming practices.	
Unit no Content CH Learning Outcome	
1 Agricultural biotechnology-scopes and application To understand the basic	
7 of agriculture biotechnology	1,2
2 Biofertilizers-Definition, Types (bacterial, fungal, To learn about	
phosphate solubilizers RGA Plants Azolla); Kind of hiofertilizers	1.2
association, Mode of application and merits, current	1,2
practices & production of biofertilizers	
Biopesticides- Introduction, types (bacterial-Bacillus To learn about	
thruingiensis, Viral –NPV, fungal-Trichoderma), Mode biopesticides	
of action, factors influencing, Genes involved and target pests; Biological approach in pest management, 10	1,2
Use of antisense RNA technology for extending self-	1,2
life of fruits and flower, Importance of JH &JH analogs	
in pest controll	
Post-harvest management, Assessment of postharvest To learn about post-	
d losses due to storage pests; Environmental factors and harvest management	
storage pests in stored perishables, cereals and grain legumes; Major groups of post-harvest pests (insects, 12	1,2
mites and rodents) Management practices of	1,2
economically important post-harvest pest; Application	
of Biotechnology in post-harvest management	
Genetic engineering for abiotic stress, Male sterile  To learn about	
5 plant, method of inducing male sterility, Bar star and applications of	1,2,3
barnase system biotechnology in agriculture	
Practical Preparation and formulation of microbial biopesticide To apply the knowledg	e
(bacteria, fungi and viruses),	
In vitro evaluation of medicinal plants against biotechnology	
pathogenic microbes,	
Preparation and formulation of microbial biopesticide	1,2,
(bacteria, fungi and viruses),  In vitro explosion of medicinal plants against	3,4
In vitro evaluation of medicinal plants against pathogenic microbes.	
Study of root/stem nodule& study of VAM,	
Vermicomposting	
Mushroom cultivation	

# **Text books**

T1: Corporate Crops: Biotechnology, Agriculture, and the Struggle for Control (English) (Paperback) by Gabriela, University of Texas Press

## Reference books

R1: Biotechnology in Agriculture: Utilization of Molecular markers\nin Mango (Mangiferaindica L.) (English) (Paperback) by Ahmed Mansour, Omayma M Mahmoud Ismail, VdmVerlag Dr. Muller Aktiengesellschaft& Co. Kg R2: Environmental Science and Engineering 2nd Edition (English) 2nd Edition (Paperback) by J. Glynn Henry, W. Gary Heinke, Phi Learning Pvt. Ltd.

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Discuss and apply the concept of Bio pesticides, biofertilizers to get better yield.	1, 3,						
2	Apply the concept of Post harvest modification to maximize the storage of food/ vegetables.	3						
3	Explain the various steps involve in seed certification.	4						
4	Describe the principles and techniques of genetic engineering used to enhance abiotic stress tolerance in plants and to induce male sterility.	1, 2						
5	Apply the potential applications of biotechnology in agriculture, including genetic modification, crop improvement, and sustainable farming practices.	1, 2, 3						



# Assam down town University

# Curriculum and Syllabus

# Master of Science in Botany

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.2

# **FACULTY OF SCIENCE**

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the

programme and to be eligible for the degree. This volume also includes the prescribed literature,

study materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Member Secretary, Academic Council

Downey

# Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

# Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multi disciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality inter disciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stake holders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

# **Programme Details**

# **Programme Overview**

M.Sc. in Botany is a 2-year post graduate programme which deals with basic and advanced study on plants and develops understanding and knowledge for applying on to the agricultural, horticultural, floricultural and environment & forest sectors. Botany is one of the multi-disciplinary fields with great demand in various applications in the field of research and development. After completion of this course, students may opt for various higher studies like M.Phil, and PhD which will improve the chances for better jobs.

# I. Specific Features of the Curriculum

- Experiential learning
- Constructivist approach to learn
- Practical and project based learning

# II. Eligibility Criteria:

B.Sc. in Botany/Life Science/Biological Science/Allied subject related to Botany.

# III. Program Educational Objectives (PEOs):

- **PEO1:** AdtU Botany Postgraduates will be prepared for successful careers in both government and private sectors as botanists, angiosperm taxonomists, pathologists, plant microbiologists, ecologists and in allied areas.
- **PEO2:** The Postgraduates will be academically prepared to become botanist and will contribute effectively to the growth of the profession.
- **PEO3:** The Postgraduates will engage in professional activities to enhance their stature and simultaneously contribute to the profession and society at large and be successful in higher education in botany or interrelated disciplines if perused.

# **IV.** Program Specific Outcomes (PSOs):

- **PSO1:** Experiential Learning: Demonstrate expertise in applied botany for sustainable community and societal outcomes.
- **PSO2** Innovation and Entrepreneurship: Ability to critically analyze research problems with proper gap analysis and design projects in the field of plant science to find appropriate innovative solutions.
- **PSO3:** Global Competency: Demonstrate global competency through empowering lifelong learning and contributing to technological advancement in botanical science.

# V. Program Outcome (PO):

- **PO1:** Disciplinary Knowledge: Apply comprehensive knowledge of basic sciences, biostatistics, biosciences and specialization in plant sciences to resolve complex agricultural, ecological and botanical challenges.
- **PO2: Problem Solving:** Identify, formulate, analyse, and evaluate complex botanical problems by applying critical thinking and drawing a conclusive solution.
- **PO3:** Investigation and Research: Apply research competency to design hypotheses and experiments using modern tools and techniques, and analyse and interpret the data to arrive at logical conclusions in the area of plant biology.
- **PO4:** Communication: Effectively communicate information among the scientific community and society and be able to prepare documents and reports, and deliver impactful presentations.
- **PO5:** Professional Codes and Ethics: Comply with values, professional codes and ethics in the profession.

- **PO6:** Environment and Sustainability: Understand the impact of the suggested solutions in a socio-environmental context, and redesign it for better ecological balance and environmental sustainability.
- **PO7:** Leadership and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO8:** Lifelong Learning: Able to engage in lifelong learning independently in the broadest context of scientific and technological advancement.

## VI. Total Credits to be Earned: 88

# VII. Career Prospects:

M.Sc. in Botany offers a range of dynamic career opportunities. Graduates can work in research and development, Agricultural, Horticultural, Floricultural and Environment & forest sectors. Roles include Environmental Impact Assessment for complex ecological and environmental problems to meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. Additionally, graduates can pursue careers in contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to application of plant resources in human welfare. Skill based courses like Mushroom Cultivation, Bio fertilizer etc. appropriately trained personnel for the promotion of mushroom production. Opportunities also exist in academia and education, where graduates can contribute to scientific knowledge and train future professionals.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

# A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations			
		Allotted		
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30		
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30		
3.	Assignment	10		
4.	Presentation (SP)	10		
5.	Quiz	5		
6.	Class Performance based score*	5		

^{*}are compulsory

Note: Total Internal assessment should be out of 40

# INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

# **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

# Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;

iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

## II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

# **III. Pattern of Question Papers**:

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test						
1 Remember		List, Define, tell, describe, recite, recall, identify, show who, when,						
1	Kememoer	where, etc.						
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.						
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify						
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.						
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.						
6	Create	Design, Formulate, Modify, Develop, integrate, etc.						

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

# IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

# V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the

invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

# **VII.** Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

# VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

# C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

# i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weight age given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

# ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

# iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade **Grade Points Description** O 10 Outstanding 9 Excellent A+A 8 Very Good 7 B+Good В 6 Above Average  $\mathbf{C}$ 5 Average P 4 **Pass** F 0 Fail 0 Absent Abs 0 Unfair Means **UFM** 

**Table 2: Letter Grades and Grade Points** 

# iv. Grade Point Average:

# a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses

graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

# b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

# **D.** Post-Examination

# i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

# ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

(i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.

- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

# INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

# 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned problem. The same has to be done in group so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social

interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

# The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

# Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file.

# SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code   Course Litle	Course Title	Course Category		Eng	gag	gen	nen	t		N N			
	17.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSBO1101R	Plant Ecology and Phytogeography	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSBO1102R	Plant Diversity	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
ter I	3	24MSBO1103R	Plant and climate change	DSC Minor	1	0	2	0	0	0	2	40	60	100	200
Semester	4	24MSBO1104R	Floral morphology, Embryology and Palynology	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	5	24UMFS1101R	Fundamental of Statistics	MDC	1	0	2	0	0	0	2	40	60	100	200
	6	24UMPD1101R	English (PDP)	AEC	0		4	0	0	0	2	0	0	100	100
	7	24UMCC1101R	Co-curricular	Co and extra- Curricular	0		0	0	0	0	1	0	0	100	100
			Total								17				1200
	S.	Course Code	e Course Title	Course	Engagement				t			Maximum Marks for			
	No.	•		Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSBO1201R	Plant taxonomy and systamatics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSBO1202R	Microbiology and plant Pathology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBO1203R	Plant Physiology and Biochemistry	DSC Major	3	0	2	0	0	0	4	40	60	100	200
ter II	4	24UMPD1201R	Aptitude / Logical Course	AEC	0	0	4	0	0	0	2	40	60	0	100
Semester	5	24MSBO1205R	Postgraduate Practice Teaching	SEC	1	0	0	0	0	0	1	0	0	100	100
Se	6	24MSBO1206R	Research methodology and statistical analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using Microsoft excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSBO1204R	Field Visit	Field Training	0	0	0	0	0	0	1	40	60	0	100
	9	24UMEC1201R	Extra-curricular	Co and Extra Curricular	0	0	0	0	0	0	1	0	0	100	100
1											$\vdash$				

	S. N.	Course Code	Course Title	Course Category						ent		Maximum Marks for			
	1 10		71	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSBO2101R	Plant molecular biology and biotechnology	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	2	24MSBO2102R	Bioinstrumentation	DSC Major	2	0	2	0	0	0	3	40	60	100	200
П	3	24MSBO2103R	Plant cell, genetics and plant breeding	DSC Major	2	0	2	0	0	0	3	40	60	100	200
Semester III	4	24MSBO2104R	Plant anatomy, microtechnique and evolution	DSC Major	2	0	2	0	0	0	3	40	60	100	200
Se	5	24MSBO2105R	Gardening and nursery technology	DSC Major	1	0	2	0	0	0	2	40	60	100	200
	7	24MSBO2106R	Internship	Internship	0	0	0	0	0	0	4	0	0	100	100
	8	24MSBO2107R	Project dissertation	Research	0	0	8	0	0	0	4	0	0	100	100
	9	24MSBO2109R	Field Visit	Field Training	0	0	0	0	0	8	1	40	60	0	100
	10	24UMPD2101R	English (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	11		Indian Knowledge System	VAC (Online)	0	0	0	0	0	0	2	0	0	100	100
	Total										27				1500
	S. N. Course Code Course Title		Course	]	Eng	ga	gei	nei	nt			laximu Iarks f			
	IN.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSBO2203R	Project dissertation	Research	0	0	24	8	12	0	16	0	0	100	100
		]	<b>Elective course: Stude</b>				_		_		_	per			
		Group1ElectivePaper: Angiosperm Taxonomy											ı		
	2	24MSBO2201R	Angiosperm Taxonomy-I	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBO2202R	Angiosperm Taxonomy-II	DSC Major	2	0		0		0	2	40	60	0	100
			Group1IE	lectivePape	er:	Mi	cr	obi	iolo	gy					
r IV	2	24MSBO2201R	Microbiology-I	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester IV	3	24MSBO2202R	Microbiology-II	DSC Major	2	0	Ĭ			0	2	40	60	0	100
Ser	<u> </u>		Group1IIEle		: P	lan	t l	Eco	olog	зу			ı		T
	2	24MSBO2201R	Plant Ecology-I	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBO2202R	Plant Ecology-II	DSC Major	2	0	0	0	0	0	2	40	60	0	100
			Group1IIElectivePap	er: Plant P	hys	siol	log	y a	ınd	Bio	chei	mistr	y		
	2	24MSBO2201R	Plant Physiology and Biochemistry-I	DSC Major (Elective)	3	0	2	0	0	0	4	40	60	100	200
	3	24MSBO2202R	Plant Physiology and Biochemistry-II	DSC Major (Elective)	2	0	0	0	0	0	2	40	60	0	100
			Total	(Liccust)	1	1		1			22		<u> </u>		400
			Grand Total								88				4400
	ì		Granu Tulai	on End Ex								1			17700

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEMES	TER – I											
Course	Title			Plant	Diversity-	·I									
Course	a code	24MSBO111R	Tota	l credits	: 4	L	,	ГП	P	S	R	0/1	F	C	
				ours: 45'		3	-	0 2	2	0	0	0		4	
Pre-rec		Nil		-requisit							Nil				
Progra					cience in 1		•								
Seme	ester		Fall/ I semes												
		1. Introduce the con-	cept of div	ersity, li	te cycle j	patterr	n	of '	vas	scul	ar an	id no	n-v	ascular	
Course	hi aatiwaa	cryptogams.	cryptogams. 2. To make learner understand about the Phylogeny and economic values of vascular										lar and		
Course O	bjectives		non-vascular cryptogams.											iar and	
		3. To impart various ap		lower cr	entogams f	or hur	ma	n w	elf	fare					
CC	)1											ortan	ce.		
		Describe the characteristics of algae, identify, classify and their economic importance.  Describe the characteristics, identify, classify fungi and lichen, and their economic													
CC	)2	mportance.													
CC	)3	Describe the characteristics, identify, classify Bryophytes, and their economic important									ice.				
CC		Describe the characteri		•								_			
CC	)5	Illustrate the industrial		-		•									
Unit-No.		Content		СН		Learn			_					KL	
I	ALGAE:	General account	of Algae,	8	Able to	descri	ibe	an	d	exp]	lain a	about			
		etic relationship, Class			the diffe						algae	and			
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	_	per the classification													
		conomic importance of										_			
II		General account	_	12	Able to										
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		(Alexopoulos and Mims). Study of nt classes of fungi as per the			economic	тпро	JI li	ance							
		tion of Alexopoulos										1	,2		
		conomic importance fu											-	,_	
		: General account	-												
	structure	and reproduction, Cla	ssification,												
	Economic	importance Lichen.													
III		HYTES: General a	10 Able to describe and explain about												
		es, Classification of l									hytes				
	· / ·	Study of different			and their	econo	om	ic ir	np	orta	nce.		1	,2	
		es as the classification													
IV		e importance bryophyte <b>OPHYTES:</b> General		10	Able to	descri	iba	922	А	evn	lain a	hout	+		
1,4	Pteridoph			10	the differ					_					
		ytes (Smith), Study of			and their					-	_	J <b></b> U		•	
		of Pteridophytes as				_	-	_	1	-			1	,2	
		tion of Smith (1955),	-												
	importano	ce Pteridophytes.													
V		D CRYPTOGAMS:		5	Able to					_					
	_	technology: algal biofu	_		the differ	ent ap	opl	icati	ior	ıs of	alga	e and			
		zer, Algal culture, Bior			fungi.								1	,2	
	_	Biotechnology: Prod													
	Cell Prote	cid, Secondary metabol	nes, Single												
Practical		of range of thallus organ	nization	30	Able to	eval	lai+	1 0	րժ	de	mon	strate	-		
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	_	of morphological, anato											1	,2,3,4	
	-	ive features of some fur													
	growing i														
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3. Study of morphological and anatomical	•	
features of some lichens growing in Assam.		
4. Study of some important genera of		
Bryophytes and Pteridophytes available in		
NE India with respect to their morphology,		
anatomy and reproductive structures.		

- T1. Textbook of Algae. B. P Sarabhai, C.KArora, Anmol Publishing Pvt. Ltd. New Delhi.
- T2. Phycology (4th Edition) R.L. Lee, Cambridge University Press.
- T3. Algae-An introduction to Phycology-CV and enHoek, DGMann, HMJanes, Cambridge University Press, 1995.
- $T4.\ Hand Book of Microal galculture. Edby A. Richmond. Blackwell Publishing House.$
- T5. Algae-Anatomy, Biochemistry and Biotechnology-L.Barsanti & P.Gualtieri.

Taylor & Francis.

### **Reference Books**

- R1. Hand Book of Microalg alculture. Ed by A.Richmond. Blackwell Publishing House, 2003.
- R2. Algae-Anatomy, Biochemistry and Biotechnology-L. Barsanti & P. Gualtieri. Taylor & Francis, 2006

# **Other Learning Resources:**

https://www.sciencedirect.com/journal/algal-research

https://www.sciencedirect.com/topics/immunology-and-microbiology/lichen-organism

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the characteristics of algae, identify, classify and their economic importance.	1, 3,4, 6							
2	Describe the characteristics, identify, classify fungi and lichen, and their economic importance.	1, 3, 4, 6							
3	Describe the characteristics, identify, classify Bryophytes, and their economic importance.	1, 3, 4, 6							
4	Describe the characteristics, identify, classify pteridophyte and their economic importance.	1, 3, 4, 6							
5	Illustrate the industrial, agricultural and environmental aspects of algae and fungi.	2, 3, 4, 6							

			SEMES	TER –	·I						
C	ourse Title				t Diversity-	II					
	ourse code	24MSBO111R	Total credits:		L	Т	P	S	R	O/F	С
			Total hours:	45T+3	0P 3	0	2	0	0	0	4
Pr	e-requisite	Nil	Co-rec	quisite			1	Nil			
P	rogramme		Ma	aster of	Science in	Botany	7				
,	Semester		Fall/ I semes	ster of	first year of	the pr	ogran	nme			
Cour	se Objectives	1. To understand the	e geological tim	e scale	and types of	fossil	5.				
		2. To make learner	understand ab	out the	Phylogeny	and ec	onomi	c valu	es of	gymnos	perms
		and angiosperms.									
		3. To understand, ex	xplain and demo	onstrate	the methods	s of pla	nt exp	loratio	n tech	niques.	
	CO1	Explain Geological Time-scale, fossils, and its role in oil exploration.  Describe the characteristics, identify, classify gymnosperms, and their economic important									
	CO2										
	CO3	Describe the charac		-						morphol	logy.
	CO4	Discuss the method						oncep	t.		
	CO5	Demonstrate the me	thod to prepare	_	aintenance o						
Unit-		Content		СН		Learr	ing O	utcom	ie		K
No.											L
I	•	ne-scale fossilization	n and Fossil	10	Able to d			_			
		essions, incrustation,			geological	time so	cale an	d diffe	erent ty	pes of	
	_	petrifactions, coal bal			fossils.						1
	_	carbon dating—Role									$\begin{vmatrix} 1, \\ 2 \end{vmatrix}$
	-	alient features and af perms- Pro-Gymnos									2
		ales, Bennettitales, P									
	Cordaitales	iles, Defineutiales, I	emoxylales,								
II		of Gymnosperms (S	norne 1965)	- Q	8 Able to describe and explain					ut the	
11		tudy of vegetative, a								onomic	
	_	tructure of Cycadale	-		importance		unu	unon		monne	
	=	ferales, Ephedrales &	_		p o.r	•					1,
		ortance of Gymnosp									2
		es of Gymnosperms	•								
	Angiosperms a	and Pteridophytes.									
III	Origin and evo	olution of Angiosper	ms; In	10	Able to d	escribe	and	expla	in abo	ut the	
	florescence and	d flowers; Co-evolut	ion of flower		evolution	and	1 1	morph	ology	of	
	_	s; Morphology of sta			Angiosperi	nic flo	wer.				1,
	_	nodia; nectaries; type									2
		f in feriorovary; plac									
	-	Role of morphology	and anatomy								
TX 7	in plant taxono		D 4	10	A11 4 1	'1	1	1	. 1	-4 41	
IV	-	assification: Linnaeu		10	Able to d different		and ficatio	-	ın abo system:		
		akhtajan, Bessydicta ts and demerits. Inter			angiospern		псано	)II S	system	S 01	
		Iomenclature, Botani			angiosperii	15.					
		survey of India. Inte									1,
		enclature (ICN). Hist									2
		major rules of nome	•								
	_	a, species, genus and									
	traspecific cate		<b>3</b> /								
V		ant exploration; Man	agement of	7	Able to d	escribe	and	expla	in abo	ut the	
		r herbariain India an	_		methods of			_			
	Specimen prep	paration for herbarium	n, Role of								1
		onomy. Charcteristic									1, 2
		d botanical description									
	-	selected order-Fabal									
	Lamiales, Mal	pighiales, Liliales &	Poales								

Pra	1. Study of some important genera of	30	Able	to	explain	and	demonstrate	
ctic	gymnosperms available in NE India with respect		gymno	osperr	ns and ang	iospern	ns.	
al	to their morphology, anatomy and reproductive							
	structures.							
	2. Study of Angios permic flowers as well as							1,
	stem and leaf with analytical drawings.							2,
	3.							3,
	Collectionandpreparationofherbariumspecimens							4
	ofcommonplantsforfamiliarizationofherbariumte							
	chniques.							
	4. Botanical description and identification upto							
	the rank of species.							

- T1. A Textbook of Botany: Angiosperms. B.P. Pandey; S.Chand Publishers Introduction to Embryophyta–Pteridophytes, Parihar, N.S. 2005. Central Book Dep, Allahabad.
- T2. Palaeobotany. Shirpad N. Agashe. 1995. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

#### **Reference Books**

- R1. Plant Systematics, Gurucharan Singh, 2017. Oxford & IBH Publishing company (P) Ltd, New Delhi.
- R2. Taxanomy of Angiosperms. Pandey. B.P. 2009. S.Chand & Co. Ltd. New Delhi.

# **Other Learning Resources:**

https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/fossil-plant https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/gymnosperm

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain Geological Time-scale, fossils, and its role in oil exploration.	1, 3, 6							
2	Describe the characteristics, identify, classify gymnosperms, and their economic importance.	1, 3, 4							
3	Describe the characteristics, identify, classify Angiosperm based on their floral morphology.	1, 3, 6							
4	Discuss the method for classifying plants, ICN principles and taxa concept.	1, 3, 4							
5	Demonstrate the method to prepare and maintenance of herbarium.	2, 3, 4, 6							

			SEMI	ESTER –	I									
Cor	urse Title		Plan	t ecology	and pl	hyto	geogra	phy						
Cor	urse code	24MSBO111R	Total c	redits: 4		L	T	P	S	R	O/F	C		
			Total hour		60P	3	0	2	0	0	0	4		
	-requisite	Nil		quisite					Nil					
	ogramme			Aaster of										
	emester		Fall/ I sem											
Cours	e Objectives	1. To study about pl	-											
		1	environment pollution and the effects of pollution on plants and ecosy Population and Community Ecology, Ecological succession.											
		1	_	e concept of phytogeography, different routes and barriers										
		migration, centers o												
		significance of NE r	_	icht i nyu	ogcogra	артис	ai icgi	0115 01	maia	and the	Diodiv	CISIL		
	CO1	Explain the factors influencing environment.												
	CO2	Explain the factors influencing environment.  Explain population and community ecology.												
	CO3		Describe ecosystem structure and function.											
	CO4	Explain the principle				serva	tion.							
	CO5	Describe principle			dynan			phyto	ogeogr	aphy,	demon	strate		
		phytogeography of l		,	J		_	1 ) ^	J 5*	1 27				
Unit-	Content	<u> </u>		СН	Learn	ing (	Outco	me				K		
No.												L		
I		onment: Physical e		10	Able	to u	ndersta	and ab	out th	ne ecos	system,			
	biotic enviro	onment, Concept of	habitat and		enviro	nme	nt and	global	warm	ing.				
		width and overlap;												
	and realized niche; resource partitioning; character displacement. Laws of limiting													
		_	_											
		ronmental pollution	-									1,		
	1 -	ypes of pollutants										2		
		air, soil and wate	-											
	1 -	to assess the pol pollution on plant	lution level,											
		bal warming and en												
	-	en house gas, acid ra												
II	Population		Community	8	Able	to d	lescrib	e and	expla	in abo	out the			
	Ecology:	<del></del>			popula				_					
	Characterso	fpopulationecology,d	lensity,Size						·					
	ofpopulation	n,Spatialdistribution,a	agestructure,											
		tality,bioticpotential,	populationd									1,		
	ynamics,gro											2		
	1	n,competitionandco-	t. 15											
	_	peciesInteractions,Co	-											
	0,	eofcommunities;com	munitystruc											
III		cies diversity.  Ecology: Ecosyster	n etmoture:	10	Abla	to c	vnlein	aharr	t tha	etmoto	re and	1		
111	ecosystem	function; energy		10	function					su uctu	alu allu			
	Biogeochem		Ecosystem:		Tunion	011 01	ccosj	o <b>cc</b> ino.						
	_	c cycles, mineral cy	•									.		
	_	ture and function of										1,		
		terrestrial (forest, gr										2		
	aquatic	_												
	1 '	marine, estuarine),	Ecological											
	succession.													
IV	Conservation	•	nciples of	10					-		nature			
	conservation		paches to		and its	s con	servati	on stra	itegies			1,		
	managemen	*	studies on									2		
	conservation	/management strat	egy (Project											

	Tiger, Project Elephant, Biospherereserves), biodiversity: status, monitoring and documentation in situconservation, exsituconservation, protectedare as in India, sanctuaries, national parks, biospherereserves. Botanicalgardens,			
	fieldgenebanks, seed banks, invitrorepositories, cryobanks etc.			
V	Phytogeography: Definition, principles and objectives of Phytogeography, Descriptive and Dynamic Phytogeography, Continuous and discontinuous plant distribution in India; Routes and barriers to plantmigration, Centers of origin (Primary and secondary centers'); Endemism Types; Endemism in Indian flora; Age and Areahypothesis, Phytogeographical regions of India. The biodiversity significance of NE region.	7	Able to describe and explain about phytogeography and endemism.	1, 2
Pract ical	<ol> <li>Determination of minimum size, number of quadrates necessary to study herbaceous communities.</li> <li>Determination of abundance, density, frequency of plant communities by quadrate method.</li> <li>Preparation of a map of India showing biogeographical zones.</li> </ol>	30	Able to explain and demonstrate minimum size of quadrate for population study and determine the results upon field study.	1, 2, 3, 4

- T1. A Textbook of Plant Ecology by R.S. Ambasht
- T2. Palaeobotany. Shirpad N. Agashe. 1995. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

## **Reference Books**

- R1. Ecology Environmental Science and Conservation by J.S. Singh, S.R. Gupta & S.P.Singh.
- R2. Bharucha, F.R.-A textbook of plantgeography. Oxford UniPress.

# **Other Learning Resources:**

 $\frac{https://www.sciencedirect.com/journal/perspectives-in-plant-ecology-evolution-and-systematics}{https://link.springer.com/journal/11258}$ 

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the factors influencing environment.	1, 3, 6						
2	Explain population and community ecology.	1, 2, 3, 6						
3	Describe ecosystem structure and function.	1, 3, 6						
4	Explain the principle and approaches used for conservation.	1, 3, 6, 7						
5	Describe principle, objectives, and dynamism of phytogeography,	1 2						
3	demonstrate phytogeography of India.	1, 3						

			SEMESTER -	I									
Course Title Bioinstrumentation													
Course c	ode	24MSBT111R	Total credits: 2	L	T	P	S	R	O/F	С			
			Total hours: 30T	2	0	0	0	0	0	2			
Pre-requ	isite	Nil	Co-requisite	Nil									
Program	ıme	Master of Science in Botany											
Semest	er	Fall/ I semester of first year of the programme											
Cours			f chromatography, centrif	_				gel elec	trophores	is etc.			
Objectiv	ves		ifferent types of chromato										
		* *	3. Application of Electrophoresis, Blotting and Microscopic Techniques etc.										
CO1			stand and differentiate										
CO2		Students will gain comprehensive knowledge of the types, principles, and applications of gel											
		electrophoresis, PCR, blotting technique and microscopy.											
CO3		Understanding on different separation techniques using centrifugation.											
CO4		_		and its applications.									
CO5		Students will under	stand spectroscopic me										
Unit-		Conte	ent	СН		Lea	rning (	Outcom	ıe	KL			
No.						A11							
I	1	~	y; Classification; Types,	7		Able to describe, illustrate an explain the chromatography an							
	1 *		cation & analysis (Paper,			-		1,2					
	1	_	nn, Partition, Thin layer,		their applications								
	1		Ion exchange, and Gel										
***		omatography):	A 1' 4' T	0		1	. •1	'11 4	, 1				
II	Gel	1	Application; Types;	8				-	rate and				
	1	• • •	nciple); Dialysis, PCR: application. Blotting			piain the otting		opnores mique	is, PCR,	1,2			
	1	• •	stern, & Northern blot.			icroscop		iiiique	and	1,2			
	1	roscopy: Introduction,			1111	croscop	у.						
III			Application; Principle;	5	Δ1	ale to d	lescribe	illusti	rate and				
111			nalytical centrifugation.						and and				
			echnique: Introduction,	5	explain the centrifuge  Able to describe, illustra				rate and				
-,	1	re, detection & measu							1,2				
			inits, radioactive decay.							-,-			
V			: Introduction, Principle	5	Able to describe, illustrate and					1.0			
	_	application of spectroso	•			plain the				1,2			
		•								+			

T1. Upadhyay. Biophysical chemistry: principle and technique. 12th edition. Himalaya Publishing House Pvt. Ltd; 2017.

# **Reference Books**

- R1. Kakkar. Atomic and Molecular Spectroscopy. 1st edition. Cambridge English.
- R2. Evans. Handbook of Chromatography. 2nd Edition, Willford Press.
- R3. Holme and Peck. Analytical biochemistry. 3rd edition. Longman.

# Other Learning Resources:

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromatography

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Students will understand and differentiate between various chromatographic methods.	3						
2	Students will gain comprehensive knowledge of the types, principles, and applications of gel electrophoresis, PCR, blotting technique and microscopy.	3						
3	Understanding on different separation techniques using centrifugation.	3						
4	Understanding of Radio-Isotope Dating and its applications.	2						
5	Students will understand spectroscopic methods.	2						

			SEMESTER - 1	I								
Course '	Title		Field	d stud	y-I							
Course	code	24MSBT111R	Total credits: 2	L	T	P	S	R	O/F	C		
			Total hours: 60P	0	0	4	0	0	0	2		
Pre-requ	iisite	Nil	Co-requisite				Nil					
Progran	nme		Master of Se	cience	in Bot	tany						
Semes		Fall/ I semester of first year of the programme										
Course Ob	•	_	nts the field knowledge of				_	_	ups.			
			2. Collection of wild plants from their habitat for preparation of herbarium.									
3. Floristic study of a particular area and preparation of												
CO1 Illustrate the methods of plant specimen collection and preservation.												
CO2 Summarize strategies for plant specimen sample collection.												
CO3			of management and main			-	rved pl	ant spec	imens.			
CO ₄		Identify and preserv	re plant species of differen	t plan	t group	s.						
COS	5	Write comprehensive report on the field exploration.										
Practical		Conto		СН		Lea	rning (	Outcom	ie	KL		
			e neighbouring states of	60	Abl	le to d	escribe	, illustr	ate and			
		• /	the collection and						bitats of			
			imens like algae, fungi,			-	_	-	lso able			
			lophytes, gymnosperms						explain			
		giosperms from their							on and			
			llected specimens from		pre	servatio	on of sp	ecimen	s.	1,2		
		y herbarium techniqu										
			collected algae, fungi	fungi								
	_	nens from field by pro										
	_	=	sion of field report and									
	herbar	ium.										

**T1.**Payel Paul, Siyanda Dear, Dr. Monoranjan Chowdhury . Herbarium Technique: First Edition. Orange Books Publication Pvt. Ltd; 2020.

#### **Reference Books**

R1. Handbook of Field and Herbarium Methods, Rao, R R & S K Jain, 2016.

# **Other Learning Resources:**

https://www.sciencedirect.com/science/article/pii/S0169534722002956 https://www.researchgate.net/publication/349640811_Herbarium_Technique

	CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome								
1	Illustrate the methods of plant specimen collection and preservation.	1								
2	Summarize strategies for plant specimen sample collection.	3								
3	Explain the methods of management and maintenance of the preserved plant	4.5								
3	specimens.	4,5								
4	Identify and preserve plant species of different plant groups.	3								
5	Write comprehensive report on the field exploration.	4,5								

	SEMESTER – I											
<b>Course Title</b>	MI	NI RESEARCH (REV	TEW	OF LI	TERA	TURE	Z-R1)					
Course code	24MSBT114R	Total credits: 2	L T P S R O/F									
		Total hours: 60P	0 0 0 4 6 0 2									
Pre-requisite	Nil	Co-requisite	Nil									
Programmes		Master of Science in Botany										
Semester		Fall/I Semester of Fire	st Yea	r of th	e Prog	ramm	e					
Course	To develop studen	ts scientific writing skil	1									
objectives												
CO1	Develop competen	ce in writing and abstra	cting	skills.								
CO2	Evaluate and under	rstand technical writing	skill.									
CO3	Comprehend differ	rent methods and techni	iques c	of resea	ırch.							

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Employ databases and library resources to gather original research, books, and articles effectively	2
2	Summarize and differentiate between various types of reviews, specifically analytical and descriptive reviews.	2
3	Identify research topics and employ appropriate methods for collecting and filtering information.	2
4	Critically analyze the demonstrations and findings of previous authors to comprehend their contributions and insights.	3
5	Compose a detailed review that explains the prospects and future directions of the chosen study.	3

			SEMESTER –	I								
Course	Title		Fundamen		f Statist	tics						
Course	code	24UMFS111R	Total credits: 3	L	T	P	S	R	0	/F	С	
			Total hours: 30T+30P	2	0	2	0	0	(	)	3	
Pre-req	uisite	Nil	Co-requisite				Nil				ı	
Prograi	mmes		Master of S	cienc	e in Bot	any						
Seme	ster		Fall/I Semester of Fir	st Ye	ar of th	e Progr	amme	!				
Course ob	jectives	1. Help to un	derstand the role of statisti	ics in	data ana	ılysis, d	ecision	n-making	, and	scie	ntific	
		research										
			students to descriptive st								lency	
			le) and measures of dispers									
			ents how to summarize ar	id pre	esent dat	a effect	ively i	ising tabl	es, c	harts	, and	
CO	1	graphs.	:CD:		1 D	1						
CO		mprove understanding of Descriptive Statistics and Demography.  Develop knowledge to understand the Probability theory, Distribution, and sampling methods.										
CO			e to understand the met									
	3	analysis.	e to understand the met	nous	ioi iiyi	ounesis	iesiii.	ig and o	ololoş	gicai	uata	
CO	4	1	to understand the principl	es of	various	statistic	al anal	vses of d	ata			
CO			on R language for data an			<u> </u>	ur uriur	y 5 C 5 O 1 C	<u> </u>			
Unit-No.		Cont		СН		Learnii	ng Qui	come		K	L	
I	Statistic		finition and scope of	5				standing	of	1,2		
			atistical population and		Statistic			C				
		-	nd qualitative, attributes,				•					
			rement nominal, ordinal,									
	interval	and ratio.										
II	Present	ation: tabular an	d graphical, including	5	Proficie	ncy in	Data	Presenta	ition	1,2		
	histogra	m and ogives.	Measures of Central		and Ana	alysis						
		•	d positional. Measures of									
	_		eviation, mean deviation,									
			ent of variation, skewness									
	and kur					_						
III			scatter diagram, simple,	5	Knowle	_	on	Analy	- 1	1,2,3		
	<b>F</b>	-	ation (3 variables only),		Bivaria	te Data	and Ke	lationshi	ps			
		nials and exponentia	ear regression, fitting of									
IV			sample point and sample	8	Underst	andina	of Dr	obability	and	1 2 2		
1 7	1		of Events, concepts of		Distribu	_	01 11	obability	and	1,2,5		
	_	_	austive events. Definition		District	itions						
		•	and relative frequency									
	_	-	lity space, Properties of									
	1	•	of events, Conditional									
	probabi	lity, total and com	pound probability rules,									
	Normal	probability I	Distribution, Binomial									
	probabi	lity Distribution,	Poisson Probability									
		-	n and its applications.									
V	_	• •	ametric test: t-test, z-test,	7	1		• •	hesis Tes	sting	1,2,3		
	1 -		netric test: One sample		and Sta	tistical '	Γests					
			on Signed test, Mann-									
D	_	Test, Kruskal wails		20	A 1	1 1	1			1.0.0	4	
Practical		=	ogramming language and	30			-	using R	tor	1,2,3	,4	
		•	is and graphics. Syntax of		data ana	ııysıs ar	ıa vısu	alization				
	_		and assignment, vector									
			gular sequence, logical dex vectors; selecting and									
		ng subsets of dataset	_									
		•	bjects, matrices, partition									
	Data	especies. Dueste data o	Jew, manieco, paranon		<u> </u>							

of matrices, arrays, lists, creating and using these			
objects; Functions- Elementary functions and			
summary functions, applying functions to subsets of			
data. Data frames: The benefits of data frames,			
creating data frames, combining data frames, Adding			
new classes of variables to data frames; Data frame			
attributes.			
3. Importing data files: import. data function, read.			
table function; Exporting data: export. data function,			
cat, write, and write. table functions, function,			
formatting output - options, and format functions;			
Exporting graphs -export. graph function. Graphics in			
R: creating graphs using plot function, box plot,			
histogram, line plot, steam and leaf plot, pie chart,			
bar chart, multiple plot layout, plot titles, formatting			
plot axes; Visualizing the multivariate data: Scatter			
plot, Q-Q plot, P-P plot.			
4. Performing data analysis tasks: Reading data with			
scan function, exploring data using graphical tools,			
computing descriptive statistics, one sample tests,			
two sample tests, Goodness of fit tests.			
5.Parametric test and non-parametric test			

# **Text books:**

T1: Methods in Biostatistics by K S Negi, ISBN: 9789374735053, 4th Edition, Year:2023, AITBS Publishers, INDIA

### Reference books

R1; "Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig

R2: "Statistics" by David Freedman, Robert Pisani, and Roger Purves

### Other learning resources:

https://www.sciencedirect.com/journal/computational-statistics-and-data-analysis

CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Improve understanding of Descriptive Statistics and Demography.	2							
2	Develop knowledge to understand the Probability theory, Distribution, and sampling methods.	2							
3	Develop knowledge to understand the methods for hypothesis testing and biological data analysis.	2							
4	Develop knowledge to understand the principles of various statistical analyses of data.	2							
5	Develop knowledge on R language for data analysis	3							

			SEMESTER -	I										
Course Ti			CTIVE ENGLISH (Con						· -					
Course co	de	24UMPD111R	Total credits: 2	L	T	P	S	R	O/		C			
			Total hours: 60P	0	0	4	0	0	0	)	2			
Pre-requis		Nil	Co-requisite				Nil							
Programn		Master of Science in Botany  Foll/I Semester of First Veer of the Programme												
Semester		1 75 : 4 1	Fall/I Semester of First Year of the Programme  To introduce the types of sentences and their significance.											
Course object	etives				_		.1	1	:4:	1_:11	1_			
		, , ,												
		3. To familia organizatio		the m	portane	6 01	uress	s coc	168 11	n va	Hous			
		To give insight into English pronunciation and into central concepts in phonetics.												
CO1		8	able students to analysis a											
CO2			able to integrate the sl								ional			
		communication.	<b>5</b> -w we si				· F - Sar	5	- P1	- 200				
CO3			e sessions will boost their	confiden	ce and	morals	S.							
CO4		•	about the effective and eff											
CO5		Introduction to Pho	netics and its importance	will impro	ove the	learne	rs 'pr	onunc	ciation	1.				
Unit		Con	tent	Contact		Lear	ning (	Out C	ome		KL			
				Hour										
MODULES	Read Techn and in Interp Liste What Facto betwo Impro Conf Defin of Co Confil	ling Skills Iniques of Effective Information from a temperature of Effective Information of Effective Information, Type of Confluentiation,	lamatory and Assertive res, Common Errors, comonyms  Reading, gathering ideas ext The SQ3R Technique rocess of Listening, Pect Listening, Difference earing, Purpose and Listening, How to ss,  lict Management, Effects Methods to deal with	assertive sentences. Transform and enhance grammatical accuracy and s formation skills.  2. Develop strategies for fast reading with better comprehand improve the ability to reand organize textual inform systematically.  3. Understand the fundamer aspects and importance of listening. It also helps to enlinterpersonal and profession communication by practicin listening skills.  4. Learn strategies to manager resolve conflicts effectively encourage a positive environ by turning conflicts into opportunities for growth.  5. Enhance productivity and management through effect allocation and planning. It hunderstand the importance of and services and services and management through effects allocation and planning. It hunderstand the importance of allocation and planning.					r faste prehe to recomment of one contact of the co	sentence aster chension recall mation ental nhance onal ing age and y to onment ad stress ctive time				
	<b>Activ</b> will b	be given to the stude s how to handle the	ng activity: A situation nts and they will have to situation or solve the	understand the importance of time management in achieving personal and professional goals.										

### Text books:

- T1: Wren, P.C and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
- T2: English Grammar in Use, Raymond Murphy 4th edition, CUP.
- T3: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

# Reference books:

R1; English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.

R2: Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	This course will enable students to analysis and identify the different types of sentences.	2
2	Learners will be able to integrate the skills of reading and speaking in professional communication.	3
3	Dress code Etiquette sessions will boost their confidence and morals.	3
4	Students will learn about the effective and efficient utilization of time.	2
5	Introduction to Phonetics and its importance will improve the learners 'pronunciation	2

	SEMESTER – I											
Course Title		M	OOCS-	I								
Course code	24MSCE111R	Total credits: 2	L T P S R O/F									
		Total hours: 30T	0	0 0 0 0 0								
Pre-requisite	Nil	Co-requisite		Nil								
Programmes		Master of S	cience	in Bota	any							
Semester		Fall/I Semester of Fir	st Year	r of the	Progra	amme						
Course objectives	As per the course	opted.										
Course outcomes	As per the course opted.											
Course description	As per the online 1	naterial available										

Teaching Objective	As per the course opted						
Learning Outcomes/Course Outcome	As per the course opted						

### **Course content:**

As per the online material available.

# Reference:

https://www.coursera.org/programs/assam-downtown-university-on-coursera rzqtn?currentTab=CATALOG

			SEMESTER										
Course			Plant cell, Ge					_					
Course	code	24MSBO121R	Total c			L	T	P	_				С
		270	Total hour			3	0	2	(				4
Pre-req		Nil		equisite						Ni	l		
Progra		***			nce in Bot								
Seme			ter/II semester								41		1-4'-1
Course Obj	ectives	1. Introduce the basic of quantitative and problem-								_	tneir	ana	aryticai,
		*	•					_			nosome	m	annina
			To provide insight into structure and functions of chromosomes, chromosome mapping, plyploidy and cytogenetic aspects of crop evolution.										
		F	_	_		out pl	ant	br	eed	ing (	biectiv	ves.	modes
		To impart theoretical knowledge and practical skills about plant breeding objectives, modes freproduction and genetic consequences, breeding methods for crop improvement.											
CO	1	Describe the structure, fur											
CO	)2	Explain structure and fun	ction of chroma	tin, DN	NA conden	satio	n, p	lar	nt c	ytosł	celetal	gen	nes, cell
		cycle and apoptosis.											
CO	)3	Describe chromosome st	tructure, its inv	olveme	ent in sex	dete	rmi	ina	tioı	ı, ab	erratio	ns	and its
		impact on crop evolution.											
CO		Explain the structure, reg											
CO	05	Describe hybridization,	-	ease re	esistance,	trans	gen	es	an	d pı	actice	ba	ckcross
TI ' NI	G	methods of plant breeding	3.	CII	T .								7.1
Unit-No.	Content	£	£1111	<b>CH</b> 10	<b>Learnin</b> Knowled						£11	ŀ	KL
I		, functions and biogenesi na membrane. Structure a		10	and its or	_			iciu	re c	or cen		
	_	nic cell organelles and			and its of	ganc	nes.	•					
		Nuclear envelope,									1	1,2	
		trafficking between	-										
	cytoplasr	=											
II	Chromati	in structure in eukaryotes,	condensation	8	To lear	n th	e 1	ba	sic	stru	ıctural		
	and pack	aging of DNA in prokary	otes. Structure		organisat	sation of chromatin and						1	1,2
		ction of plant cytoskelet	•		genes.							1	1,2
	gene pro	ducts. Cell cycle and apop	tosis.										
III		ome: Structure and	,	10	To know				cł	irom	osome		
		ere and telomere. Sex			and its be	enavı	our.	•					
		sms, sex chromosomes,											
	aberratio	1 '	deficiencies/									1	1,2
	deletions	, inversions, tions. Role of chromosom	interchanges/										
		evolution. Ploidy chang											
	_	ls and aneuploids.	,es. Haptoras,										
IV		ructure of gene. Prok	arvotic gene	10	To under	rstand	l th	e 1	าลรา	cs o	f gene	+	
1,4		n. Mendelian and N		10	structure						_		
	-	ce. Chromosome theory			modifica		-	•					
		ic Genome: Evolution,											
		tion. Gene regulation. Rec										1	1,2
	Eukaryot	es. Linkage and crossin	g over: basic										
	_	, linkage maps, correlati	-										
	_	nysical maps, Post	translational	nal									
**		tions of eukaryotes.	. 1 **	-	A 1 1	-	••			1	1 .		
V	-	es and scope of pla	_	7	Able to						•		
	-	ation in self and cross-polition in self-and cro	-		about to breeding		meti 1d		ds its		plant fferent		
	_	. Breeding for disease	-		application		ıu	J	ıs	ul	HICICIII	1	1,2
		e, transgenes and trans			аррисан	0113.							
		gene transfer through											
		,											

	Transfer of gene through individual chromosome for distant hybridization. Back Cross methods of plant breeding.			
Practical	<ol> <li>Preparation of stains and staining techniques for chromosome analysis.</li> <li>Chromosome analysis, study of chromosome behaviour inmitosis and meiosis.</li> <li>Karyotyping of dicot (mitosis)</li> </ol>	30	Describe, illustrate and explain and apply staining techniques and carry out microscopic examination.	1,2,3,4

- T1. Genetics, B.D. Singh, Kalyani Publishers.
- T2. Introduction to Genetic Analysis, 9th edition by Griffiths et al.
- T3. Principles of Genetics by Snustad etal (2004).

### **Reference Books**

- R1. Concepts of Genetics, Klug, Cummings and Spencer.
- R2. An Introduction to Plant Breeding, Jack Brown & Peter Caligiri.
- R3. Fundamentals of Plant Breeding, Kuckuck, Hermann, Kobabe.

# **Other Learning Resources:**

 $\frac{https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/chromosome}{https://link.springer.com/journal/10577}$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the structure, function and biogenesis of cell and its organelles.	1,3					
	To provide insight into structure and functions of chromosomes,						
2	chromosome mapping, polyploidy and cytogenetic aspects of crop	1,2					
	evolution.						
3	Describe chromosome structure, its involvement in sex determination,	1,4					
3	aberrations and its impact on crop evolution.	1,4					
4	Explain the structure, regulation of prokaryotic and eukaryotic gene and its	1,2					
7	function.	1,2					
5	Describe hybridization, inbreeding, disease resistance, transgenes and	1 4					
3	practice backcross methods of plant breeding.	1,4					

			SEMES	STER – II								
Course '	Title		Microb	iology and	Plant P	atholo	gy					
Course	code	24MSBO122R		redits: 4	L	T	P	S	R	O/F	C	
				rs: 45T+30	P 3	0	2	0	0	0	4	
Pre-requ		Nil		equisite				Nil				
Program		XX70 /		ter of Scien								
Semes		1. The course deals with the i		ster of Firs					m aail	*******	in maille	
Cour Object		and its application in the field				ersity C	or mile	obes 1	n son,	water, a	лг, пшк	
Object	1103	2. To make learner understar				micro	organi	sms at	nd thei	r growtl	h in the	
		laboratory condition and also					-			-		
		studies.			•						J	
		3. To impart the concept of sy	ymptomolo	ogy and epi	demiolo	gy of c	liffere	nt plar	ıt disea	ise.		
CO	1	Describe about diversity of m										
CO2	2	Demonstrate the method of is	solation, p	ure culture,	preserv	ation o	of mic	robes a	and des	sign to e	stimate	
		microbial growth.										
CO	3	Describe application of m	nicroorgan	isms in a	gricultu	re, fe	rmente	ed foo	od, da	airy, bio	o-waste	
CO		management.		4'1 1'	11	1 4'	<u> </u>				1 1 1	
CO ₂	•	Explain innate and acquired responses, antibodies, cells and tissues of immune system, serological reactions and sero diagnostics.										
CO	<u> </u>	Describe symptomatology, epidemiology and host-pathogen relationships, defense mechanisms,										
00.	,	and strategies for plant diseas	_	,g, and no	or parino	gen re	iuuioii	лиро,	acrons	,c meen	dinionio,	
Unit-		Content		СН		Lea	rning	Outco	me		KL	
No.												
I		bial diversity- 'Species' and		10	Knowle	dge of	f micr	obial	diversi	ty and		
		ept in microbiology, ICN fo			ecology	<b>7.</b>						
		ria and other microbes, mic									1,2	
	conce	ept, ecological significar obes, microbiology of soil, a										
	and m		ii, watei									
II	Micro		n of	10	To le	earn	about	the	mie	crobial		
		bes, pureculture, preservatio			techniq							
		lture, growth, media ster			1							
	and o	disinfection, sterilization tec	hniques,								1,2	
		ation estimation (directs por									1,2	
		spectrophotometric method										
	cultur		hniques,									
III		e preservation and maintenan ed microbiology- Applica		7	To kno	NW1-	O11¢ +1	10 00	diesti-	one of		
111		bes in the field of agr			microbi							
		ented foods and dairy p				.515gy	4111	-1-111 3	201013.	·	1,2	
		try and bio-waste managemen										
IV		inology- Immunity, Inna		8	To u	nderst	and	the	basic	s of		
		red immunity, antibodies, c			immun	ology a	ınd caı	ncer bi	ology.			
		s of the immune system,									1,2	
		ses, serological reactions ar	nd sero-									
	dıagn	ostics, cancer biology.										

V	Plant Pathology-Symptomatology and epidemiology, methods of studying plant diseases, stages in disease development, recognition and entry processes of different pathogens like Bacteria and fungi in plant host cells, host-pathogen relationship, Systemic Acquired Resistance (SAR) and Induced Systemic Resistance (ISR), Control of plant diseases.	10	Able to describe and explain about the disease caused by different microbial agents in plants.	1,2
Practical	Isolation and pure culture of microbes from soil, air, water and disease plant materials.     Identification and characterization of isolated pure cultures.     Estimation of bacterial growth by spectrophotometric method and counting of cells.     Study of plant pathogenic fungi from diseased specimens (symptoms, causal organism and their morphological & reproductive characters.	30	Describe, illustrate and explain and apply microbial and plant pathogenic techniques and carry out microscopic examination.	1,2, 3,4

- T1. Microbiology-Pelzer, Chan, Krieg Tata McGraw Hill Publications. 5th Edition.
- T2. Prescotts Microbiology, Dorothy Wood, Joanne Willey, Kathleen Sandman. 12th Edition.

### **Reference Books**

- R1. P D Sharma, Microbiology and Plant Pathology, Rastogi Publication.
- R2. P Chakraborty, A Textbook of Microbiology, New Central Book Agency 3rd Edition (2013)

### **Other Learning Resources**

https://www.sciencedirect.com/journal/microbiologicalresearch

https://www.sciencedirect.com/special-issue/10DQJXMVLPT

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe about diversity of microorganisms.	1, 3, 4					
2	Demonstrate the method of isolation, pure culture, preservation of microbes and design to estimate microbial growth.	1, 3, 6					
3	Describe application of microorganisms in agriculture, fermented food, dairy, bio-waste management.	2, 3, 4, 5, 6					
4	Explain innate and acquired responses, antibodies, cells and tissues of immune system, serological reactions and sero diagnostics	1, 2, 3					
5	Describe symptomatology, epidemiology and host-pathogen relationships, defense mechanisms, and strategies for plant disease control.	1, 3, 4, 6					

	<b>n</b> G									
Total hours: 45T+30P 3 0 2										
		_	R O/F	C						
	Total hours:         45T+30P         3         0         2         0         0         0									
Pre-requisite Nil Co-requisite	Ni	il								
Programme Master of Science in Botany										
Semester Winter/II semester of First year of the programme										
Course 1. This course aims to educate student on concepts of proteins, enzymes.										
Objectives 2. Basic plant signaling mechanisms, sensory photobiology.										
	3. The course further deals with physiology of plant hormones, reproduction, enzymology									
metabolism, photosynthesis and respiration.										
CO1 Describe membrane transport mechanism and environmental stress on plants.	1		- C							
Explain mechanism of electron transport system during photosynthesis and pat	nway	ус	10							
photorespiration and respiration.  CO3 Describe plant hormones, enzymes, regulation of enzymes and Enzyme Kinetic	2.0									
CO4 Explain structure of protein and role of thermodynamics in plants.	28.									
CO5 Describe signal transduction in Bacteria and plants.										
Unit- Content CH Learning Outcome				K						
No.   Content   CH   Learning Outcome				L						
I Membrane transport and trans location of water 10 Knowledge of plant transport	rt and	ıd s	stress	<del>-</del>						
and solute. Stress physiology: Waterstress, heat biology.		1	50							
Stress, coldstress. Flooding and ROS formation				1,						
and oxidative stress (Uniport, Symport, Anti				2						
port channels, Pressure flow model, Polymert										
rapping mode).										
II Photosynthesis: Light harvesting system, 10 To learn about the plant pho	t harvesting system, 10 To learn about the plant photosynthe									
Mechanisms of electron transport, photo reactions.										
protective mechanisms, CO ₂ fixation-C ₃ , C ₄										
and CAM pathways. Respiration and photo				1,						
respiration: Citric acid cycle; plant				2						
mitochondrial electron transport and ATP										
synthesis, alternate oxidase, photo respiratory										
path way.										
	know about the biosynthesis and									
down and translocation. Mechanism of action of applications of plant hormon	ies.			1,						
plants hormones. Enzyme and regulation,				2						
Enzyme kinetics and other growth regulators,										
Derivation of Michaelis Menten equation.	4 1	L	1	_						
IV Protein structure and protein synthesis (folding, 8 To understand the protein st	tructi	ure	e and							
ticketing, degradation, purification, detection and functional characterization), Application of										
principles of thermodynamics in biology. Nitrate				1						
and ammonium as similation, amino acid				1, 2						
biosynthesis complex, Translational proof -				_						
reading, Translational inhibitors and Post-										
Translational modification of proteins.										
V Signal Transduction: Overview second 10 Able to describe and explain	in ab	วดเ	ut the							
messengers, receptors and G-proteins, signal transduction in plants.		•								
phospholipid signaling, role of cyclic				1,						
nucleotides, specific signalling, mechanisms and				2						
their regulation. Specific signalling.										
Mechanismin bacteria and plants.										
Pract 1. Determination of water potential using 30 Describe, illustrate and e	xpla	iin	and	1,						
ical gravimetric method. apply plant physiolog	gical		and	2,						
2. Extraction of carbohydrates from plant biochemical reactions.				3,						

materials and estimation of reducing and non-	.   4	1
Reducing sugars.		
3. Extraction and estimation of proteins from		
plant materials by Lowry's method using BSA		
standard curve.		
4. Extraction of chloroplast pigments and		
quantitative estimation with determination of		
cholorophy ll a/b ratio and total chlorophy ll in		
C3, C4 and CAM plants.		

T1. Buchanan B.B, Gruissem W. and Jones R. L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

T2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley &Sons, U.S.A. 4th Edition.

#### **Reference Books**

R1. Bajracharya, D., (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

# **Other Learning Resources**

https://www.sciencedirect.com/journal/journal-of-plant-physiology https://www.sciencedirect.com/topics/medicine-and-dentistry/plant-physiology

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe membrane transport mechanism and environmental stress on plants.	1,2.6							
2	Explain mechanism of electron transport system during photosynthesis and pathway of photorespiration and respiration.	1,3,8							
3	Describe plant hormones, enzymes, regulation of enzymes and Enzyme Kinetics.	1,2,3							
4	Explain structure of protein and role of thermodynamics in plants.	1,3,8							
5	Describe signal transduction in Bacteria and plants.	1,3,8							

	SEMESTER - II									
Course Title	,	Techno Professional Skil	ls –I (	Mushr	oom C	ultiva	tion)			
Course code	24MSBO124R	Total credits: 2	L	T	P	S	R	O/F		C
		Total hours: 60P	0	0	4	0	0	0		2
Pre-requisite	Nil	Co-requisite			•	Ni	il			
Programme		Master of S	cience	in Bot	any					
Semester		Winter/II semester of F	irst y	ear of	the pro	gram	me			
Course objectives	1. To create aware	ness about the Mushroom	amon	g the p	eople.					
	2. To strengthen	the promotion of mushr	coom	cultiva	tion by	esta	blish	ing a v	vell-	equiped
	laboratory and o	offices.								
	3. To know and ex	plore the cultivation in As	ssam.							
CO1	Describe the method	l of producing mushroom	spawı	n and th	ne culti	vation	proc	ess for	musl	nrooms,
	including substrate	preparation, inoculation	n, an	d env	ironmei	ntal c	condi	tions r	equii	red for
	successful growth.									
		ues involved in fungal cul						-		as agar
		d culture techniques, and s	•							
		ues for cultivating mushro			_				ing	optimal
		re, and light conditions, as								
		ement of spent mushroon					tegie	s for co	mpo	sting or
		recycle organic waste and								
		rcial aspects of mushroor				_		•	sis, b	ousiness
		gies for developing entrepr								
Practical		ontent	СН			ning (				KL
	1	niques for production of	60		erstand		the	cellu	lar	1,2,
	_	Staining techniques:		orga	nizatio	n and	funct	ions		3,4
		ivation of mushroom.								
		ishroom spent (waste).								
		aining on commercial								
	-	s of mushroom (field/								
	industry visit).									

### **Text books**

- T1. Mushroom Cultivation Technology by Joy Sarkar, Krishnendu Acharya, Anirban Roy (Author). Publisher: Techno World.
- T2. Handbook of Mushrooms 4th Edition by Bahl N, Oxford & Ibh Publishing

# Reference books

- R1. Mushroom Cultivation by Parveen Garg, Publisher: B.R. Publishing Corporation, ISBN:9788193031421.
- R2. Mushrooms: A Manual for Cultivation by S. Biswas, M. Datta, S. V. Ngachan, PHILearning

# **Other Learning Resources:**

 $\frac{https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/mushroom-growing \\ https://www.sciencedirect.com/science/article/pii/S2666833521000769}$ 

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the method of producing mushroom spawn and the cultivation	1.2.3
	process for mushrooms, including substrate preparation, inoculation, and	
	environmental conditions required for successful growth.	
2	Illustrate the techniques involved in fungal culture for mushroom spawn	1,2,3,4
	production, such as agar plate methods, liquid culture techniques, and spawn	
	generation using grain or sawdust.	
3	Explain the techniques for cultivating mushrooms, including methods for	2,3,6
	maintaining optimal humidity, temperature, and light conditions, as well as	
	managing pests and diseases.	
4	Describe the management of spent mushroom substrate, including strategies	2,3,7
	for composting or vermicomposting to recycle organic waste and improve soil	
	fertility.	
5	Explain the commercial aspects of mushroom production, including market	3,4,7
	analysis, business planning, and strategies for developing entrepreneurship in	
	the mushroom industry.	

	SEMESTER -II										
Course Title		Mini Research (Research gap analysis-R2)									
Course code	24MSBO125R	Total credits: 2	L	T	P	S	R	O/f	C		
		Total hours:60	0	0	0	4	12	0	4		
Pre-requisite	Nil	Co-requisite				Ni	l				
Programme		Master of Science in Botany									
Semester		Winter/II semester of	First y	ear of	the pro	gramı	ne				
Course	1.To determine whet	ther the objectives of re-	view of	literati	ıre gap	analys	sis ha	ve beer	n met, if not		
objectives	what steps can be tak	en accordingly.									
CO1	Create and implemen	t a plan to bridge the gap	)								
CO2	Find the gap and eval	luate solutions.									
CO3	Identify the ideal futu	re state/action plan									
CO4	To analyse the currer	nt state/work of research									
CO5	To implement the str	ategies to meet the resea	rch gap	under	supervis	sion.					

# Text books

1. T1. Multiple Stressors: Literature Review and Gap Analysis (WERF Research Report Series) by S.M. Swanson.

	SEMESTER – II											
Course Title		Open elective- Coursera										
Course code	24MSBO126R	Total credits: 2	L	L T P S R O/F					C			
		Total hours: 30T	0	0	0	0	0	0	2			
Pre-requisite	Nil	Co-requisite		Nil								
Programmes		Master of S	cience	in Bota	any							
Semester		Winter/II semester of l	First ye	ar of tl	he prog	ramme	•					
<b>Course objectives</b>	As per the course op	ted.										
Course outcomes	Course outcomes As per the course opted.											
Course description	As per the online ma	terial available										

Teaching Objective	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

# **Course content:**

As per the online material available.

# Reference:

 $\underline{https://www.coursera.org/programs/assam-downtown-university-on-coursera\ rzqtn?currentTab=CATALOG}$ 

COURSE T	TTI E		SEMESTER – Research Methodolo		d Stati	sticel A	\ nelve:	6			
COURSE 1		24UMRM121R	Total credits: 2	ogy and L	d Stati T	stical A	Analysi S	s R	O/f	C	
Course co	oue	24UMRM121R	Total hours:15T+60S	1	0	0	4	0	0/1	2	
Pre-requi	cita	Nil	Co-requisite	1	U		Nil		U		
		INII	Master of	Saiona	in De	tony	INII				
Program Semeste			Winter/II semester of				одиот	<b></b>			
Course objec		1 The course sime	s to enhances the student						oroh mat	hodology	
Course objec	uves						_			inodology	
		including theory of science and qualitative and quantitative methods in research.  The course scales to enhance the students' skills for developing critical thinking through									
		2. The course seeks to enhance the students' skills for developing critical thinking through research literature review in different domain. Consequently, it aims to develop skills for									
		preparation of a research proposal for a master' thesis project/Mini research.									
		F -	udents competency in p						and pro	esenting a	
		research project.	adents competency in p		,, com		, • • • • • • • • • • • • • • • • • • •		una pr	eseming .	
CO1			basic knowledge of Rese	arch m	ethods						
CO2			the knowledge of Research								
CO3			ole to gain the Skill questi								
CO4			ble to acquire the knowled					on P	rocedure		
CO5		Knowledge on diff		.50 01 0	usic it	eport a	isser tat.		- Cocaire	•	
Unit no		Cont	<u> </u>	СН		Learn	ning Ou	ıtcon	1e	KL	
I	Resear			2	Und	erstand			esearch	1,2	
_			of research, motivation	-		nodolog			vations,	,_	
		•	gnificance of research,		type	_	gnifica:		good		
			Defining the Research				_		lefining		
		_	of research problem,			arch pro			υ		
		ity of defining resea				1					
II			g and need of research	4	Mas	ter	researc	h	design	1,2	
		-	good design, different		prin	ciples,	sampli	ng m	ethods,		
	researc	ch designs, Samp	ling Design- steps in		_	eriment	_	esign,			
	sampli	ng design, Sampl	le Size determination,		vari	ous AN	OVA :	and f	actorial		
	criteria	for selecting a sar	npling design, different		desi	gns.					
	types o	of sampling design	, Experimental Design,								
	Princip	oles of Design of E	Experiment, One – way								
	ANOV	A, Two- Way	ANOVA, CRD, RBD,								
	LSD, 2	22, 23 Factorial Des	sign								
III	Types	of data, sources of	data collection, tools of	3	Lear	n data	types	, co	llection	1,2	
			, ordinal, interval and			nods,	scale	-	survey		
	ratio-	Attitude scale				uments	*		atistical		
		_	es, semantic differential		anal	-	for	r	esearch		
			n statistical analysis,		ques	stionnai	res.				
			ews preparation and								
		•	opment of survey								
	instrun		analysis for the								
	questic		1		3.5			1		1.5	
IV			research report, Format	3	Mas		researc		report	1,2	
		•	erent steps of writing			_		-	writing,		
	_	-	esearch report, how to				_	-	ethods,		
	organiz				and	bibliog	raphy p	repai	ation.		
	_	-	standard methods of								
	-		result, written and oral								
	_		et, format of research								
	_	-	statistics - tabular and								
			uses of references, ation of bibliography								
V			ht (IPR), Introduction	3	IInd	erstand	IPR		oncepts,	1,2	
<b>, ,</b> ,			R, IPR in India and	3					eworks,	1,2	
	anu li	ne need for IPR	, irk iii maia and		gion	ai ailu	muidil	11 41116	works,	<u> </u>	

	worldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications, Patentable and non-patentable, patenting life, Filing of a patent application, The different layers of the international patent system, Case studies on Basmati rice, Turmeric, and Neem patents		patents, trademarks, and key case studies.	
Practical	Laboratory using R Software:  1 Analysis of One-way ANOVA;  2 Analysis of Two-way ANOVA;  3 Analysis of CRD  4 Analysis of RBD  5 Analysis of 22 and 23 Factorial Experiment  6 Simulation-I using R (Bernoulli, Binomial, Poisson and Geometric distribution.).  7 Simulation-II using R (Exponential and Normal distribution).  8 Simple random Sampling  9 Stratified Random Sampling	60	Conduct and analyze ANOVA, CRD, RBD, factorial experiments, simulations, and sampling using R software.	1,2,3,4

### Text books

T1. Jerome L. Myers, Arnold D. Well, Robert F. Lorch, Jr. Research design and statistical analysis, 3rd edition.

#### Reference books

R1. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn & Bacon.

https://www.sciencedirect.com/journal/statistical-methodology

https://www.sciencedirect.com/journal/computational-statistics-and-data-analysis

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Students will have basic knowledge of Research methods.	2					
2	Students will gain the knowledge of Research Methodology.	3					
3	Students will be able to gain the Skill questionnaire development.	3					
4	Students will be able to acquire the knowledge of basic Report/dissertation Procedure.	1					
5	Knowledge on different IPR rights	2					

			SEMESTER – II										
Course Tit													
Course co	de	24UUHV101R	Total credits: 2	L	T	P	S	R	O/F	C			
D .	• .	2101	Total hours:15T+30P	1	0	2	0	0	0	2			
Pre-requis		Nil	Co-requisite	L.,			Nil						
Programn		***	Master of Science										
Semester	<u> </u>	1	Vinter/II semester of First ents appreciate the essenti	•					13.7 A T T	IEC! and			
Course objective	6	•	* *		-	•							
objective	3	'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings											
			evelopment of a Holistic	persp	ective a	ımong	studer	nts to	owards	life and			
			as towards happiness and p			_							
		1 *	and the rest of Existence.	•	-					_			
		Universal Human V	alues and movement towar	ds val	ue-base	d living	g in a r	natura	al way				
		3. To highlight plausit	ole implications of such a H	lolistic	unders	tandin	g in tei	ms c	of ethic	al human			
		1	d mutually fulfilling huma	n beha	iviour a	nd mu	tually	enric	hing in	teraction			
		with Nature.											
CO1			is course is explorational				•		e. It in	volves a			
CO1		1 -	tudy of the human being vi	s-a-v18	the res	t of ex	stence						
CO2		It is free from any dogma	a or value prescriptions.  Evestigation and self-explor	ration	and no	t of air	vina s	armo	ne W/1	nateves in			
COS			is stated as a proposal and			_	-						
		1	: Natural Acceptance and su						•	t iii tiicii			
CO4			oration takes the form of a							tudents			
			o continue within the studer	_									
CO5			so enables them to criticall										
		beliefs.								_			
Unit			Conte	nt									
I	•	Understanding the	need, basic guidelines, cont	ent an	d proces	ss for V	Value I	Educa	ation				
	•	*		hat is it? - its content and process; 'Natural Acceptance' and Experiential									
			nechanism for self-explorat										
	•	= =	ess and Prosperity- A look			_							
	•	Right understanding, Relationship and Physical Facilities- the basic requirements for											
		<del>-</del>	tions of every human being			_	-	241					
	•	Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario											
	•	Method to fulfil the above human aspirations: understanding and living in harmony at various levels.											
II	•		manbeingasaco-existenceof	hesen	tient'I'a	ndther	nateria	1 'Rc	dv'				
		•	•					ıDo	dy				
	•	Understanding the needs of Self ('I') and 'Body' - <i>Sukh</i> and <i>Suvidha</i> Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)											
	•	=	characteristics and activities		_			•	, ,				
	•	_	e harmony of I with the Boo					corre	ect appi	raisal of			
		Physical needs, m	eaning of Prosperity in deta	il			-						
	•	Programs to ensure Sanyam and Swasthya-Practice Exercises and Case Studies will be											
		taken up in Praction											
III	•		mony in the family – the ba										
	•		ues in human-human relation	nship	; meanii	ng of N	Nyaya :	and p	orogran	n for its			
		fulfilment to ensu	· -			_							
	•		d Respect (Samman) as the						_				
	•	_	meaning of Vishwas; Differ						_				
	•	_	meaning of Samman, Diffe	rence	between	n respe	ect and	diffe	erentiat	ion; the			
	_	other salient value	<del>-</del>	i at 1.	oin ~	ovto	ion of	fa:1	). C=	nodba			
	•	•	harmony in the society (soc Sah-astitva as comprehensi	•	_		ion of	ıamıl	y): Sar	naunan,			
			ersal harmonious order in				Sociat	v (A	khand	Samai)			
		v isualizing a unive	asai naimomous oluci III	SUCIEL	y- Ollul	viaca	BUCIEL	y (A	KHAHU	Jamaj),			

	T	
		Universal Order (Sarvabhaum Vyawastha)- from family to world family! -Practice
		Exercises and Case Studies will be taken up in Practice Sessions.
IV	•	Understanding the harmony in the Nature
	•	Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
	•	Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
	•	Holistic perception of harmony at all levels of existence-Practice Exercises and Case Studies will be taken up in Practice Sessions.
V	•	Natural acceptance of human values
	•	Definitiveness of Ethical Human Conduct
	•	Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
	•	Competence in professional ethics:
	>	Ability to utilize the professional competence for augmenting universal human order
	>	Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems,
	>	Ability to identify and develop appropriate technologies and management patterns for above production systems.
	•	Case studies of typical holistic technologies, management models and production systems
	•	Strategy for transition from the present state to Universal Human Order:
	>	At the level of individual: as socially and ecologically responsible engineers, technologists and managers
	>	At the level of society: as mutually enriching institutions and organizations

# Guidelines and Content for **Practice** Sessions

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them

Expected outcome: the students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

PS 2: Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be man-made problems threatening the survival of life on Earth – What is the root cause of these maladies & what is the way out in your opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc – what do you think, is the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

Expected outcome: the students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living. Any solution brought out through fear, temptation or dogma will not be sustainable.

## PS 3:

- 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of
- What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect? i)
- ii) What is Naturally Acceptable to you - to nurture or to exploit others? Is your living the same as your natural acceptance or different?
- Out of the three basic requirements for fulfilment of your aspirations- right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine. Expected outcome:
- The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any

external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.

- 2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- 3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

PS 4: List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.

Expected outcome: the students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too.

PS 5:

- 1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary & tasteful→ unnecessary & tasteful→ unnecessary & tasteless → intolerable
- b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!
- 2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.
- 3. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

### Expected outcome:

- 1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.
- 2. the students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body.
- 3. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

PS 6:

- 1. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilisation of the body.
- 2. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases.

Expected outcome: The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

PS 7: Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:

1a. Do I want to make myself happy? 2a. Do I want to make the other happy?

3a. Does the other want to make him happy? 4a. Does the other want to make me happy? What is the answer?

Intention (Natural Acceptance)

1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy?

3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy? What is the answer?

#### Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention& competence as well as the others' intention & competence.

Expected outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

#### PS 8:

- 1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation.
- 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected outcome: The students are able to see that respect is right evaluation, and only right evaluation leads to fulfilment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

## PS 9:

- 1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
- 2. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children

Expected outcome: The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

PS 10: List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders.

Expected outcome: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participation(in terms of nurturing, protection and right utilization) in the nature.

#### PS 11:

- 1. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in the existence.
- 2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are

able to make out how these courses can be made appropriate and holistic.

UNIT 5: Implications of the above Holistic Understanding of Harmony at all Levels of Existence

PS 12: Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected outcome: The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

#### PS 13:

- 1. Suggest ways in which you can use your knowledge of Technology/Engineering/Management for universal human order, from your family to the world family.
- 2. Suggest one format of humanistic constitution at the level of nation from your side.

Expected outcome: The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.

PS 14: The course is going to be over now. Evaluate your state before and after the course in terms of

a. Thought b. Behavior and c. Work d. Realization

Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

Expected outcome: The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for a happy and prosperous society.

#### Text book

T1: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

#### Reference

- R1: B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
- R2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblisher.
- R3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,1991
- R4: Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
- R5:Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III,1972, limits to Growth, Club of Rome's Report, Universe Books.
- R6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantra Shodh, Amravati.
- R7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
- R8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
- R9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

### **Other Learning Resources**

- 1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
- 2.Story of Stuff, http://www.storyofstuff.com
- 3.Al Gore, An Inconvenient Truth, Paramount Classics, USA
- 4. Charlie Chaplin, Modern Times, United Artists, USA
- 5.IIT Delhi, Modern Technology the Untold Story

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being visà-vis the rest of existence.	2					
2	It is free from any dogma or value prescriptions.	2					
3	It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.	1					
4	This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.	0					
5	This self-exploration also enables them to critically evaluate their preconditionings and present beliefs.	0					

Semester-II												
Course Title	COMMUNICATION MASTERY (Communicative English & Soft Skills)								ls)			
Course code	24UMP	D121	R	Total credits: 2	L	T	P	S	R	O/f	C	
				Total hours: 15T+30P	1	0	2	0	0	0	2	
	22UMP			Co-requisite	Nil							
	Effectiv											
programme	Master	of Sci	ence ir	1 Botany								
Semester				Winter/II semester of								
Course objectives				students with the transf	ormati	on of	sentenc	es and	the	approp	riate use of	
		epositi										
				writing skills in different			_				_	
			-	ning by reinforcing, subs	_			_				
				d performance boosting a			rofessio	nal goa	l ach	ievem	ent.	
CO1				ar will polish their writing								
CO2				r communication and int								
CO3				havioural skills, thought	s, and	emoti	ons wil	l enabl	e the	m to	behave in a	
				productive way.								
CO4			-	ve impact in their though	t proce	ss and	probler	n-solvii	ıg sk	ills.		
Unit	(	Conter										
Module 1-		I.		of Prepositions								
Grammar		II.	_	questions								
		III.	*									
35.11.4		IV.		ele, complex, compound	entenc	es						
Module 2-		I.		ve and Passive Voice								
Grammar		II.		et and Indirect Speech	1. :	:4	1					
Module 3-	_	I.		Basics of Writing; avoid	amoigu	ny and	ı vaguer	iess				
Writing Skills	•	II. III.	-	graph Writing s Writing								
		III. IV.		r Writing								
		V.		me, CV and Cover Letter	•							
Module 4-		I.		OT Analysis								
Self-Manageme	nt	II.		Regulation- Goal Setting								
Skills		III.		onal Hygiene								
Module 5-		I.		t is Non-Verbal Commun	ication	& Bo	dv Lang	uage.				
Non- Verbal		II.		ents of Communication,		20	,					
Communication	n-	III.		s of Body Language,								
Sciences of Body		IV.		ortance and Impact of Boo	ly Lans	guage,						
Language		V.		s of Communication thro								
				Introduction to Haptic, Introduction to Kinesics								
VII. Introduction to Proxemics,												
	1	/III.	Body	Language Do's and Do	'ts, Do	ubt C	learing S	Session.				
Module 6- Group  I. Importance,												
Discussion (Theo	ory)	II.	Planr	ning, Elements, and Skill	s assess	sed;						
		III.		tively disagreeing,								
		IV.	Initia	ting, Summarizing and A	ttainin	g the (	Objectiv	e				

### Text book

- T1. Barrett, Grant. 2016.Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.
- T2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

#### Reference books

- R1. Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky,2019
- R2. A Textbook for AECC English Communication: Interface, Dr. Kironmoy Chetia and Pranami Bania Breez Mohan Hazarika, January 2019.

# Other Learning Resources:

https://youtu.be/x60GHpQ8gJk

https://youtu.be/Ke oSN-BCaY

https://youtu.be/TDPDtrLxT-c

https://www.classcentral.com/report/toefl-preparation/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain prepositions, tag questions, and idioms correctly.	5					
2	Discuss and analyze different sentence types and voices.	2, 5					
3	Explain effective paragraphs, precis, and professional documents.	3, 5					
4	Describe SWOT analysis, goal setting, and personal hygiene principles.	5					
5	Illustrate non-verbal communication and body language concepts.	5					

SEMESTER – II									
Course Title		MOOCS-II							
Course code	24MSCE121R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours: 30 T	2	0	0	0	0	0	2
Pre-requisite	Nil Co-requisite Nil								
Programmes		Master of S	cience	in Bota	ıny				
Semester		Winter/II semester of l	First ye	ar of tl	ne prog	ramme	e		
Course objectives	As per the course op	ted.							
Course outcomes	Course outcomes As per the course opted.								
Course description	As per the online ma	terial available							

<b>Teaching Objective</b>	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

As per the online material available.

### Reference:

	SEMESTER – III								
Course Title		MOOCS-III							
Course code	24MSCE211R	Total credits: 2	L T P S R O/F					C	
		Total hours: 30T	2	0	0	0	0	0	2
Pre-requisite	Nil Co-requisite Nil								
Programmes		Master of S	cience	in Bota	any				
Semester		Fall/ III Semester o	f 2 nd ye	ar of tl	he prog	ram			
Course objectives	As per the course opt	ted.							
Course outcomes As per the course opted.									
Course description	As per the online ma	terial available							

<b>Teaching Objective</b>	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

As per the online material available.

### Reference:

SEMESTER – III									
Course Title		MOOCS - IV							
Course code	24MSCE212R	Total credits: 2	L	T	P	S	R	O/F	C
		<b>Total hours:</b>	0	0	0	0	0	0	2
Pre-requisite	Nil Co-requisite Nil								
Programmes		Master of S	Science	in Bota	ny				
Semester		Fall/ III Semester o	of 2 nd ye	ar of tl	ie prog	ram			
Course objectives	Course objectives As per the course opted.								
Course outcomes As per the course opted.									
Course description	As per the online mat	erial available							

Teaching Objective	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

As per the online material available.

#### Reference:

			Semes	ter III							
Course	title	Techno-Professional Skills II (Bio fertilizer production)									
Course	code	24MSBT211R	Total credits	:: 2	L	T	P	S	R	O/F	C
		Total hours: 60P						2			
Pre-requ	isite	Nil	Co-requisit	te				NA	1		
Progran	nme			MS	c. Bota	ny					
Semest	er		Fall/ III Sem	ester o	of 2 nd y	ear of t	the pro	gram			
Course Obj	ectives	1. Appreciate the agr	ronomic important	ce of be	eneficia	ıl micro	o-organ	isms.			
	2. Formulate, produce and apply Bio			ertilize	rs in a p	oilot sca	ale.				
CO1	CO1 Isolate nitrogen-fixing, phosphate-so			phosphate-solubilizing bacteria, and mycorrhizal fungi cultures.							
CO2	Apply biofertilizers effectively in pac			ly field	fields, agriculture, and floriculture applications.						
CO3	1	Gain practical skills	in commercial bio	fertiliz	er prod	uction	through	n indus	stry vi	isits.	
Unit no	Conte	nt	СН	Learr	ning ou	tcome				KL	
I	Isolati	on of pure cultur	re of Nitrogen	10	Isolate	e pure	culture	es of 1	nitrog	en-fixi	ng
	fixing,	, Phosphate solubiliz	ing bacteria and		bacter	ria, pho	sphate-	solubi	lizing	bacter	ia, 1,2
	mycoł	nhrizal fungi			and m	ycorrh	izal fun	ıgi.			
II Application of biofertilizer on paddy field,				10	Apply	biofe	ertilizer	s in	padd	y field	ls,   1,2
	agricultural land and floriculture.				agriculture, and floriculture effectively.						. 1,2
III Hand on training on commercial				10	Learn	_	ommer			ofertiliz	
	produ	ction of biofertilizer	ion of biofertilizer (industry visit) production techniques through hands-						hands-	on 1,2	
					indust	ry trair	ning vis	its.			

T1: A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi. Ann Larkin Hansen 2010,

#### **Reference Books**

R1. Kannaiyan, S. 2002 Biotechnology of Bio fertilizers. Narosa publishing house, New Delhi. Dubey, R.C. 2001.

R2. Dubey, R. C. 2008. A Textbook of Biotechnology. S. Chand & Co., New Delhi.

### Other learning resources:

https://www.sciencedirect.com/science/article/pii/S2666517421000742

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/biofertilizer

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the Importance of biofertilizers in plant development.	1, 2, 8						
2	Describe mass cultivation and inoculation.	1, 2, 3						
3	Explain the importance of Azolla as a biofertilizers.	1, 2, 8						
4	Describe the importance of phosphate in biofertilizers.	1, 2, 8						
5	Apply the knowledge on the use of Fungi and Mycorrhiza.	1, 8						

	SEMESTER – III								
Course Title		Open elective (Coursera)							
Course code	24MSBO217R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours: 30T	2	0	0	0	0	0	2
Pre-requisite	Nil Co-requisite Nil						•		
Programmes		Master of S	Science	in Bota	ıny				
Semester		Fall/ III Semester o	f 2 nd ye	ar of tl	ne prog	ram			
Course objectives	As per the course opt	ed.							
Course outcomes	As per the course opted.								
Course description	As per the online mat	terial available							

Teaching Objective	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

As per the online material available.

### Reference:

			Semeste	r-III									
Cours	se title			Res	earch	Ethics							
Cours	e code	24UMRE211F	Total credits: 1		L	T	P	S	R	O/F	C		
			Total hours: 15T		1	0	0	0	0	0	1		
Pre-re	quisite	NA	Co-requisite		NA								
progr	amme				Sc. Bo								
Semo			Fall/ 3 rd Sem										
Course O	bjectives	1	ms to lay a foundati		-								
		_	ines, policies, and co		lating	to ethic	cal rese	arch, a	s we	ll as to	provide, via		
			cal theories, concepts										
CO			to describe and apply										
CO	02	1 -	an overview of imp				search	ethics	, like	e respo	nsibility for		
	32		hical vetting, and scie				a of oth	مناددند	~::				
CO		_	skills of presenting at to Identify the conce	-					_		مراديون		
	<i>J</i> 4	and reporting		pis an	a proc	edures	oi saiii	pning,	uata	conecu	on, anarysis		
Unit no		and reportii	Content					Lear	nina	OutCo	nme		
I	ETHICS:	Introduction	to the course and	each	othe	er: an	Unde				ey ethical		
1			theory. Ethics:							11.	ories in		
			al judgements and re				1 *	-		, critica			
			on; research ethics.								research		
	compromis	se and integrit	y. Data ownership	and s	stewar	dship;	ethics	i.					
	conflicts of	of interest; co	llaboration. Human	and	non-h	numan							
			earchers in society.										
II			Γ- Ethics with respe				Understand and apply ethical						
			esty and research in										
		ts: Falsification, Fabrication, and Plagiarism (FFP).											
		publications: duplicate and overlapping publications,											
	salamı slıcı	ing. Selective reporting and misrepresentation of data					recognize and prevent scientific misconduct						
III	DIIDI ICA	ATION ETHICS- Publication ethics: definition,					Understand the importance of						
111			nce. Best practices /				1						
			s: COPE, WAME,										
			onduct: definition, c				1						
			aviour and vice versa										
	of public	ation ethics, authorship and contributor ship											
	Identificati	on of public	ation misconduct,	comp	olaints	and							
			ers and journals.										
IV			SHING-Open access	•						oncept			
			E0 online resource t		•		_		of op	en acc	ess		
	1, 0		g policies. Software			•	publis	shing					
		-	eveloped by SPPU.										
	· -	ggestion tools ournal Suggeste	viz. JANE, Elsevie	r Jou	mai r	maer,							
V			NDUCT Group Dis	cuesio	one: S	ubiect	Gain	profic	rienc	v in	navigating		
*			FP, authorship. Con			-		-		-	tabases		
	_		examples and fraud				maca	<u>6</u> and	. v11a	aon ua			
	_		se of plagiarism softv										
			urce software tools.			,							
		_	RESEARCH MET	RICS	–Data	bases:							
	Indexing da	atabases. Citati	on databases: Web of	f Scier	nce, So	copus,							
			npact Factor of journ		_								
			R, IPP, Cite Score. M	1etrics	s: h-in	dex, g							
	index, I 10	indexes, altmet	rics.										

- T1. Bird, A (2006). Philosophy of Science. Routledge.
- T2. MacIntyre, Alasdair (1967) A Short History of Ethics.London.
- T3. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019)

### Reference Books

R1. National Academy of Science, National Academy of Engineering and Institute of Medicine (2009). On Being a Scientist: A Guide of Responsible Conduct in Research: Third Edition, National academics Press

R2. George R, (2011). Sociological Theory, Rawat Publication, New Delhi, India. GeorgeR, (2019). Post Modern Social Theory, Rawat Publication, New Delhi, India.

### Other learning resources:

https://researcheracademy.elsevier.com/uploads/2018-02/ethics_a5_booklet_update260617_web.pdf https://researcheracademy.elsevier.com/publication-process/ethics_

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe and apply research ethics theories and methods.	6						
2	Explain research ethics issues such as responsibility, vetting, and misconduct.	6						
3	Illustrate arguments and results in ethical research inquiries.	5, 6						
4	Identify and apply procedures for sampling, data collection, and reporting.	2, 3, 4						
5	Apply ethical principles to research design and evaluation	4,8						

		Seme	ester- III								
Cour	se title		rsonal fina	ncial pla	nning	<u>g</u>					
Cour	se code		credits: 1		Ī		P	S	R	O/F	С
			hours: 30P	•	) 0	)	2	0	0	0	1
Pre- re	equisite	22UUFL201R Co-re	equisite Nil								
	•	Introduction to Financial									
		Budgeting And Planning									
Progr	ammes	Bachelor of Business Adminis	tration/Bac	helor of	Hote	1 M	ana	gem	ent	and C	atering
		Technology/Bachelor of Bus						helo			usiness
		Administration (Industry Integration)	rated)/Bach	elor of	Socia	1 W	ork	/Bac	chelo	or of .	Arts in
		Sociology/Bachelor of Master (	*								
Sem	ester	Fall/ 3 rd Semester of 2 nd year o									
		1. The course would offer an ir			unde	ersta	ind	the	relev	vant co	oncepts
		of money, borrowing, lending, to		_							_
Co	urse	2. Assess the personal financial	planning p	rocess, th	e life	сус	ele c	of fir	nanc	ial pla	ns, and
Obje	ectives	methods of goal achievement.									
		3. Formulate a budget, record-	keeping sy	stem, an	d tax	pla	nni	ng s	trate	egy ba	sed on
		current financial goals.									
C	<b>O</b> 1	Explain the cash management ar	nd buying p	olan for h	omes	or a	uto	mob	iles.		
C	O2	Discuss a diversified investment	portfolio f	or differe	nt ob	ject	ives	S.			
C	O3	Compare mutual funds, ETFs, a	nd real esta	te invest	nent	opti	ons.				
C	O4	Develop a financial plan for reti	rement and	estate pr	otecti	ion.					
C	O5	Describe financial products and	strategies f	or long-t	erm g	oals	3				
Unit no		Content	Contact	]	Learn	ning	Ou	itcoi	me		KL
	TI24 1 T	Fundamentals of Financial	Hour								2,3
	լՄուս 1- ո	ungamentais of rinancial									
											2,5
	Planning	<u> </u>									2,5
	Planning Function	g – s of money; Inflation- Meaning,	6								2,3
1	Planning Function causes, h	g – s of money; Inflation- Meaning, ow it can be controlled; process	6	Students							2,3
I	Planning Function causes, h official p	g – s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money-	6	compreh	end t	he f	und		ntals		2,3
I	Planning Function causes, h official p simple an	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money- nd compound interest; Net		l .	end t	he f	und		ntals		2,3
I	Planning Function causes, h official p simple an Present V	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money- nd compound interest; Net Value and Future value, Power of		compreh	end t	he f	und		ntals		2,3
I	Planning Function causes, h official p simple an Present V	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money- nd compound interest; Net		compreh	end t	he f	und		ntals		2,3
I	Planning Function causes, h official p simple an Present V Compoun	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money- nd compound interest; Net Value and Future value, Power of nding; Doubling period and Rule		compreh	end t	he f	und		ntals		1,2
I	Planning Function causes, h official p simple an Present V Compour of 72.  Unit 2- I	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of money- nd compound interest; Net Value and Future value, Power of		compreh	end the plant	he f	und g.	ame		s of	
I	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning—		compreh financial	end the plant	he fining	und g. lble	ame	nder	s of	
I	Planning Function causes, h official p simple an Present V Compoun of 72. Unit 2- I Meaning Taxes, T	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneynd compound interest; Net Value and Future value, Power of nding; Doubling period and Rule  ncome Tax Planning— of Income, Direct & Indirect		compreh financial	will se the	he fining	und g. lble sic a	to u	nder	s of	
	Planning Function causes, h official p simple an Present V Compoun of 72. Unit 2- I Meaning Taxes, T	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule  ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of		compreh financial	will se the	he fining	und g. lble sic a	to u	nder	s of	
	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income,	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule  ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of		compreh financial	will se the	he fining	und g. lble sic a	to u	nder	s of	
	Planning Function causes, h official p simple an Present V Compour of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule  ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable		compreh financial	will se the	he fining	und g. lble sic a	to u	nder	s of	
	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST,	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance,		compreh financial	will will ax an	be a basad G	iund g. ible sic a	to u	nder ets o	s of estand	1,2
	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule  ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning— ng of Entrepreneurship,	6	Students and utili income t	will will	be a basad G	iund g. ible sic a ST.	to u	nder ets o	s of estand	1,2
	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.	6	Students and utili income to	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2
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II	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin prerequise entreprer ii. Entrep	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning— ng of Entrepreneurship, sites for becoming an	6	Students and utili income to the concept.	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2
	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin prerequise entreprer ii. Entrep India,	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyand compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning—ng of Entrepreneurship, sites for becoming an neur, oreneurship Support Systems in	6	Students and utili income to the concept.	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2
II	Planning Function causes, h official p simple an Present V Compoun of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin prerequise entreprer ii. Entrep India, iii. Institu	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyand compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning— ng of Entrepreneurship, sites for becoming an neur, oreneurship Support Systems in attional support systems for	6	Students and utili income to the concept.	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2
II	Planning Function causes, h official p simple ar Present V Compour of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin prerequis entreprer ii. Entrep India, iii. Institu	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyad compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning— ng of Entrepreneurship, sites for becoming an neur, preneurship Support Systems in autional support systems for neurs,	6	Students and utili income to the concept.	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2
II	Planning Function causes, h official p simple ar Present V Compour of 72.  Unit 2- I Meaning Taxes, T Income f Income, iv. Tax e v. GST, Unit 3- I i. Meanin prerequis entreprer ii. Entrep India, iii. Institu	s of money; Inflation- Meaning, ow it can be controlled; process lanning, Time value of moneyand compound interest; Net Value and Future value, Power of ading; Doubling period and Rule ncome Tax Planning— of Income, Direct & Indirect axable Income, various heads of for tax Calculation, Non-taxable vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning— neg of Entrepreneurship, sites for becoming an neur, oreneurship Support Systems in attional support systems for neurs, cial support systems for	6	Students and utili income to the concept.	will will ept, se	be a bas d G	ible street and the s	to u spec	nder	s of estand f	1,2

	v. Venture Capital, Business Angels,			
	vi. Assistant of Government,			
	vii. Commercial Bank Loans and			
	Overdraft.			
	v. Venture Capital, Business Angels,			
	vi. Assistant of Government,			
	vii. Commercial Bank Loans and			
	Overdraft.			
	Unit 4-Planning for investing in	6	Students will be able to analyze	3,4
	securities market –	O	and interpret the different	5,1
	i. Investment avenues offered by		dimensions of stock market	
	Securities Markets,. Primary Market and		investment.	
	Secondary Market,		investment.	
	ii. Stock market- meaning, features,			
	functions of NSE,BSE DEMAT trading			
	account,			
	iii. Security repository, stock brokers,			
	Operational aspects of securities markets:			
IV	placement of orders, contract note, pay-in			
1 1 1	7			
	and pay-out, trading and settlement cycle,			
	iv. Various risks involved in investing in			
	securities markets; Role of Financial			
	Intermediaries; Stock indices.			
	v. Mutual Funds- meaning concept,			
	definition, types, importance and			
	drawbacks of mutual funds, mutual funds			
	in India, investing in mutual funds,			
	vi. Systematic Investment Plan (SIP) and			
	its advantages.			
	Unit 5- Planning for debts and	6	Students will be able to evaluate	1,2,3
	Retirement		the aspects of retirement planning	
	i. Consumer credit - Introduction to		to formulate effective strategic	
	consumer credit; choosing a source of		financial plans.	
	credit, the cost of credit alternatives,			
	ii. Consumer Legal Protection;			
$\mathbf{v}$	iii. Housing Decision: Factors and			
,	Finance; Vehicle Decisions.			
	iv. Retirement planning - Meaning of cost			
	of living; retirement need analysis;			
	development of retirement plan, various			
	retirement schemes,			
	v. Estate Planning; Pension and Medicare			
	Planning; Wills.			

- 1. Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million-Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by David J. Mullen Jr
- 2. Personal Finance and Planning by Dr. Rajni
- 3. Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh
- 4. Be Your Own Financial Advisor: Financial Planning, Investment Options, Risk Management, Tax

Management, Succession Planning Kindle Edition y Sushil Bali

5. The Dumb Things Smart People Do with Their Money: Thirteen Ways to Right Your Financial Wrongs Kindle Edition y Jill Schlesinger

# Other learning resources:

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain the cash management and buying plan for homes or automobiles.	5				
2	Discuss a diversified investment portfolio for different objectives.	9				
3	Compare mutual funds, ETFs, and real estate investment options.	2, 5, 9				
4	Develop a financial plan for retirement and estate protection.	9				
5	Describe financial products and strategies for long-term goals	5				

		Semester- III								
Course tit	le	Corporate proficie	ency							
Course co	de 24UMPD211R	Total credits: 2	L	T	P	S	R	O/F	C	
		Total hours: 60P	0	0	4	0	0	0	2	
Pre-requis	ite 22UMPD121R Communicati	onCo-requisite	NA							
	Mastery									
Programm	ies	MSc. Botany	•							
Semester	Fall/ 3	rd Semester of 2 nd year	of the	pro	gran	1				
Course	1. To acquaint students with	the various tools of an	effect	ive p	resei	ntatio	n.			
Objective	s 2. To acquire the speaking	g skill, instruct, influer	ice, e	ngag	e, e	ducat	e, or	appea	se the	
	listeners.									
	3. To increase proficiency,	present ability and quali	ty of	resur	ne ai	nd pro	ovide	e guidai	nce for	
	self- promotion and self-e	evaluation in social medi	a.							
	4. To prepare and train the s	_				-				
CO1	It will prepare the learners to	speak with greater contro	ol and	l cha	risma	ı in fi	ont o	of other	s.	
CO2	It will have a positive impact		_			-	-			
CO3	It will arm the students with	all the necessary tools	and s	skill	sets	to pr	epare	profe	ssional	
	resume.									
CO4	They will learn to highlight an	nd assess themselves in s	ocial	med	ia.					
CO5	It will impart in them tech	niques to solve critical	prol	olem	s in	an i	nterv	iew, d	evelop	
	strategies to crack interviews,	improve their communi	catior	ı skil	ls, bo	oost t	heir (	confide	nce	
Unit no		Content								
I	<b>Module 1- Presentation Skills</b>									
	Introduction									
	Essential characteristics of a good presentation									
	iii. Preparation of a good preser	tation								
II	<b>Module 2- Public Skills</b>									
	i. Fear of Public Speaking,									
	ii. Understanding and Overcom	ing Fear of Public Speak	ing,							
	iii. Confidence and Control,									
	iv. Physiology and Stress - Con									
	v. Tips for Presentations and Pu									
	vi. Tips for Using Visual Aids i									
	i. Process for Preparing and Creating Presentations,									
	ii. Delivering Presentations Successfully,									
***	ix. Doubt Clearing and Summar	*	-	7.0 /	***	• . •		1 11		
III	Module 3- Practical session	on Resume, Curricul	ım V	ıtae,	, Wi	utıng	cov	er lett	er &	
	LinkedIn Profile									
	i. Preparation, submission & sci	-								
	ii. Practical session on cover let	-								
		. Creating a profile on LinkedIn								
		. How to utilize it								
	Module 4- Leadership & Man	agement Skins								
	i. Concepts of Leadership,									
	• •	. Leadership Styles,								
	_	i. Manager VS Leader,								
		7. How to be an Effective Leader,								
v. Mock/ Practice Session,										
137	vi. Doubt Clearing Session.	Writing Claille								
IV	Module 5- Research Paper – V	_								
	i. How to write a research paper	-								

ii. Key point in Research Work

#### **Module 6- Interview Skills & Dress code Ethics**

- i. Types of the interview- telephonic, virtual & face to face
- ii. Online interview, personal interview,
- iii. Panel interview,
- iv. Group interview,
- v. JAM session,
- vi. Types of interview questions-traditional/common interview questions,
- vii. Case interview questions,
- viii. General Strategies for answering questions,
- ix. Marketing your skills and experiences,
- x. Preparation before the interview,
- xi. How to dress up for an interview,
- xii. How to maintain eye contact and positive body language,
- xiii. How to be presentable,
- xiv. Interview dos and don'ts,
- xv. Introduction to Dress Code Ethics,
- xvi. Purpose and Importance
- xvii. How to Make, FIRST IMPRESSION"
- xviii. What to Wear During Interviews or Any Other Formal Meetings Male &Female

### V Module 7- Mock Interview

- i. Practical Mock Interview,
- ii. Feedback- Receiving Feedback,
- iii. Giving Feedback,
- iv. Advantages of Effective Feedback,
- v. How to deal with negative feedback.

#### **Text Books**

T1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

T2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

### **Reference Books**

R1. Garg. Manoj Kr. (2018) English Communication: Theory and Practice

### **Other Learning Resources:**

https://brightlinkprep.com/10-best-toefl-prep-books/

	CO PO Mapping					
SN	SN Course Outcome (CO)					
1	It will prepare the learners to speak with greater control and charisma in front of others.	5				
2	It will have a positive impact in their thought process and problem-solving skills.	2				
3	It will arm the students with all the necessary tools and skill sets to prepare professional resume.	5				
4	They will learn to highlight and assess themselves in social media.	5				
5	It will impart in them techniques to solve critical problems in an interview, develop strategies to crack interviews, improve their communication skills, boost their confidence	5, 6, 8				

SEMESTER - III									
Course Title		Mini Research (Survey/experiments-R3)							
Course code	24MSBO212R	Total credits: 2	L T P S R O/f C					C	
		Total hours: 60P	0	0	0	4	12	0	4
Pre-requisite	Nil	Co-requisite			•	Ni	l		
Programme		Master of S	cienc	e in Bo	otany				
Semester		Winter/II semester of 1	First y	ear of	the pr	ograi	nme		
Course	1. To determine v	hether the objectives	of rev	iew of	fliterat	ture ga	ap ar	nalysis	have been
objectives	met, if not what ste	ps can be taken accord	ingly.						
CO1	Create and imple	ment a plan to bridge tl	ne gap						
CO2	Find the gap and e	valuate solutions.							
CO3	Identify the ideal f	uture state/action plan							
CO4	To analyse the cur	To analyse the current state/work of research							
CO5	To implement the	strategies to meet the re	search	gap u	nder su	ipervis	sion.		

			SEMESTER – III						
Co	ourse Title	F	Floral morphology, Embry	ology a	nd Paly	nolog	y		
Co	ourse code	24MSBO213R	Total credits: 4	L	TP	S	R	O/F	С
			Total hours: 45T+30P	3	0 2	0	0	0	4
Pre	e-requisite	Nil	Co-requisite			Ni	l	1	
Pr	ogramme		Master of Scienc						
	Semester	_	all/ III semester of second y						
Cours	se Objectives		e origin and evolution of d	ifferen	t parts o	f flow	ering	g plants	
		1	evelopmental biology.						
3. Understand the pollen structure and its application.									
	CO1	_	nology of a flower, include	ling ac	lvanced	and p	rimi	tive str	uctures
			development stages.						
	CO2		re and function of micro			nega	spora	angium,	poller
		- '	osporogenesis), and sporog						
	CO3	_	m types, the relationship	betwe	en endo	spern	n and	d embry	o, and
		explain embryo cult							
	CO4		ations of tissue culture		_	_		_	
			c modification, somatic e	mbryo	genesis,	disea	ise e	radication	on, and
	G05	conservation.		1				• •	
	CO5		gy, including pollen an	_	_	_	-		-
			yzing pollen and spore mo	rpholo	gy usıng	micr	osco	py and s	staining
<b>T</b> T •.		methods.		CII	T =		<u> </u>		777
Unit-		Conten	t	СН	Lea	ırning	Out	come	KL
No.	Flower-Mo	rphology of flower	, inflorescence. Primitive	10	Able	to d	lescri	be and	
1		=	f stamen and carpel,					e flower	
			of flower. –evolution of		and its				1,2
	~	pollinator, Staminod					-		
II	_		nd function of wall layers,	8	Knowl	edge		about	
	_	_	Callose and tape tum in		micros	_	gia	and	
	_	lopment, Pollen wal	-		megas	orang	jia.		
	^	•	ollen mitosis, Division of						1,2
			in sperms, Pollen fertility						
	_	erility, Pollen storag	•						
III	Post-fertiliz	zation changes in	nembryosac-Endospermty	10	Able	to c	lescri	be and	
	pesand their	r development, Endo	sperm haustoria and their		1 -			he post	
	function, Er	mbryogenesis	in Monocot and				_	ges takes	
	dicotangios	perms, Structure, C	Cytology and function of		place i	n emb	ryosa	c.	1,2
	suspensor,	Physiological	and Morphogenetical						
	relationship	of endosperm and e	embryo,						
	Embryocult	ture.							
IV		•	, Basic aspects of plant		Able		lescri		
			ssue culture, and Methods		_			different	
			dium (MS and White),		tissue	cuitura	ı tech	nniques.	1,2
	_		, Cellular Totipotency,						1,2
		tion, Morphogenesis Organogenesis, Somatic							
		esis, Micropropogat		_				2.2	
V		•	ynology. Spore, pollen					e pollen	
	morphology		*		and its	applic	ation	ıs.	1,2
	Evolution	-	ypes, Application of						
	neopalynolo	ogy and palaeopaly	nology. Aeropalynology						

	and pollen			
	Allergy, melissopalynology.			
Prac	1. Study of types of ovules and anther and stages of	30	Able to explain and	
tical	embryo (Globular type and heart shaped)		demonstrate, flower	
	2. Micro propagation of important crops through tissue		analysis and	1,2,
	culture technique.		embryological and	3,4
	3. Study of pollen grains through Acetolysis technique		palynological study.	

- T1. Shivanna KR and Johri BM (1985) The Angiosperm Pollen: Structure and Function. New Delhi, India: Wiley-Eastern.
- T2. Introduction to Embryology: P.Maheswari.

#### **Reference Books**

- R1. Studies in Botany (Vol-I), J.N.Mitra, D.Mitra and S.K.Chowdhuri, Moulik publishing, Kolkata.
- R2. Bhojwani and Bhatnagar. Embryology of Angiospems.

### **Other Learning Resources:**

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/embryo-plant https://www.sciencedirect.com/journal/review-of-palaeobotany-and-palynology

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the morphology of a flower, including advanced and	1,2,3
1	primitive structures, and explain flower development stages.	
	Explain the structure and function of micro sporangium, mega	1.5
2	sporangium, pollen development (micro sporogenesis), and	1,3,6
	sporogenesis.	
3	Describe endosperm types, the relationship between endosperm and	1,2,4
3	embryo, and explain embryo culture techniques.	
	Explain the applications of tissue culture techniques in plants,	1.0-
4	including micro propagation, genetic modification, somatic	1,3,7
	embryogenesis, disease eradication, and conservation.	
	Describe palynology, including pollen and spore morphology,	124
5	chemistry, and techniques for analyzing pollen and spore	1,3,4
	morphology using microscopy and staining methods.	

			SEMESTER -	- III							
Course	Title	Ecor	nomic botany, e	thnobo	tany an	d pha	arma	cognos	sy		
Course	code	24MSBO214R	Total credi	ts: 4	L	T	P	S	R	O/F	C
			Total hours: 4		P 3	0	2	0	0	0	4
Pre-req		Nil	Co-requis					Nil			
Progra			Master			•					
Semes			I/ III semester of								
Course Ob	ojectives	1. To give knowledge			•				•	. C 1	
		2. To uplift the know	viedge of the s	tuaents	about	tne c	onve	nuona	ıı use	or med	ıcına
		plant. 3. To give knowledge	es to the studen	ta abou	ıt daval	onma	ant o	fnow	drugg	for sof	0.000
		more rational use of			ii devei	opme	ont O	i new	arugs	ioi sai	e and
СО	1	Student scan able to k			used n	lante					
CO		Describe and classify						rding	to the	ir 1100	
CO		Documentation of Eth									
CO			<u> </u>								160.0
	7	Understand the need herbal preparations.	ioi developiner	n oi ne	w urug	8 10f	sale	anu m	ore r	auonai l	ise o
СО	5	Develop laboratory sl	zill in tacting of	herbal	drugg	and n	eu c	ommo	roial +	roducto	
Unit-No.		Content	an in testing of	CH	urugs a			g Outo		nouncis	K
Unit-NO.		Content		Сп		Lea	a1 11111	g Out	ome		L
I	Introd	uction to Econon	nic Botany:	10	Able to	desc	ribe a	and exp	olain a	bout the	+-
		nt aspects of econo	<del>-</del>					-		nts and	
		of plants in relation	=	their utility							
		e, Importance of for									
		tion and commerce	=								
			-								
		of origin of culti	<del>-</del>								1,
		centre of wild pla	_								2
		s. Botany and uses of									
		ic plants, Orname	-								
		lic beverage, Plan									
	*	on control: Method									
	and e	examples. Mineral	indicating								
	plants.										
II	Classifi			8			abou	it ecoi	nomic	plants'	
		cation of economica	• •		groups						
	_	Cereals and Millets									
	_	es, Vegetables, Frui	~								
		g plants, Drug-yiel									1,
		c-yielding plants,									2
	plants,	, .	•								
		os, Rubber-yielding	-								
	-	g plants, Sugar-yie	lding plants,								
711		om cultivation etc.	· · · · ·	10	A 1-1 4	l .	i1- :	المس	.la:	h o 1-4-41	+
III		ootany: Introdu		10	Able to			-		bout the	
		otany, Different			TOIC all	u scoj	JC 01	CHIIIO (	otany	•	
		otany, Importance a	-								1,
	Ethnob	•	bal-medicine								2
	industr	y, Role of ethno med	dicine and its								
	scope	in modern times	s, Role of								
	I I		,								

	Ethnobotany in conservation and sustain able development, Centres of Ethno botanical studies in India, Use of some ethno medicinal plants by the ethnic communities of North East India. Wild and edible mushrooms of North-East India.			
IV	Pharmacognosy: Pharmacognosy and its importance, History of Pharmacognosy, Pharmaceutical Aids, pharmacologically active constituents: Carbohydrates, Proteins, Enzymes, Fixedoil, Fats and Waxes-Lipids, Volatileoils, Alkaloids, Resins, Tannins, Glycosides, Antibiotics etc, Adulteration, drug evaluation and pharmacopoeial strandards.	10	Able to describe and explain about the different active constituents of drugs derievd from plants.	1, 2
V	Classification of Drugs: Systems of classification of drugs from natural origin, Types of Plant drug and their Pharmacognostic study ) Rhizome and Root drugs: Cyperrusrotundus, Ipecac, Raulvolfia, Satavari, With ania Ginger, Turmeric etc) Leaf drugs: Datura, Senna, Azadirachta, Andrographis Clitoriaetcd) Bark drugs: Terminaliaarjuna, Cinnamon, Cinchona, Holorrhenae) Flower drugs: Saffronf) Seed drugs: Black piper, Mucunag) Fruit drugs: Cumin, Coriandrum, Amla etc ) Whole plant drugs: Catheranthusroseus.	7	To understand development of drugs from plants.	1, 2
Practical	1. Morphological and anatomical studies on economically important plants/parts of Rice, Jute, Rauvolfia, Ocimum, Tea, Sugarcane.  2. Organoleptic and microscopic evaluation of the following drug plants: Datura /Senna/ Azadirachta (Leaf drug) Zingiber/ Cyperrus rotundus (Rhizome & Root drug) Coriandrum/ Trachyspermum/ Foeniculum/ Cuminum (Fruitdrug) Cinnamon/ Cinchona (Bark drug)	30	Able to explain and demonstrate, different economically important plant parts and pollens.	1, 2, 3, 4

T1. Textbook of Economic Botany, Sunidhi Miglani.

## **Reference Books**

- R1. Economic Botany, B.P. Pandey, SChand.
- R2. BrunetonJ., 1999. Pharmacognosy, Phytochemistry, Medicinal Plants, Intercept Ltd., Paris. 2. Dewick P.M., 2002. Medicinal Natural Products: A biosynthetic approach, John Wiley & Sons Ltd.
- R3. Pharmacognosy, J.S. Qadry.

### Other Learning Resources:

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/economic-botanyhttps://link.springer.com/journal/12231

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Students can able to know the economically used plants.	1,2					
2	Describe and classify the economically important plants according to their use.	1,3,6					
3	Documentation of Ethno botanically used plants along with the type of use.	1,4					
4	Understand the need for development of new drugs for safe and more rational use of herbal preparations.	1,3					
5	Develop laboratory skill in testing of herbal drugs and new commercial products.	1,3					

SEMESTER – III											
Cor	urse Title		Plant molec	cular bi	iology a	nd bio	techn	olog	y		
Cor	urse code	24MSBO215R	Total cree	dits: 4	L	T	P	S	R	O/F	C
			Total hours:		)P 3	0	2	0	0	0	4
	-requisite	Nil	Co-requ					Ni	il		
	ogramme				Science i		•				
	emester e Objectives	1. To introduce to	Fall/ III semes							منط سمادين	1000
Cours	e Objectives	2. To define large-									
		biological in sights	. •		_		•		a seis	to deliv	c nove
		3. To give student		_	•	_			v for :	a wide r	ange of
		novel in fectious d		-		cuscu		10106.	, 101 (	. ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ge 01
	CO1	Describe DNA stru			_	cing n	rincit	oles.			
	CO2	Describe RNA stru							RNAs.		
	CO3	Explain hormones	<u> </u>								
	CO4	Explain the application									
	CO5	Describe the proce	_	_	_	nginee	red p	lants.			
Unit-		Content		CH		_	ning				KL
No.							C				
I	Structure	e of DNA, forms and function, 10 Able to describe and explain about						1 about			
	DNA t	topology, DNA	-Protein		structur	e of D	NA a	nd its	funct	ions.	
		s, DNA replicatio									1,2
	1	g and lagging st									1,2
	_	rase, polymerases									
	_		iples of DNA sequencing.								
II	Structure	•	nthesis and	8	Able to				•		
		of genetic and RNA, rI	-		structur	e of K	NA ai	na its	Tunct	ions.	
		and Processing, R	*								1,2
	-	nd Polyadenylation									
	small RNA	• •	or interes,								
III	Hormones		eptors, Cell	10	Able to	describ	oe and	d exp	lain al	out the	
	surface re	ceptors, signaling	•		role of h	ormone	es in s	ignal	transdı	action.	
	protein	coupled receptor	ors, Signal								
	transduction	on pathways, re	gulation of								
	signaling p	oathways, Bacterial	chemotaxis,								
	genome	analysis, genetic									1,2
		systematics and	-								
	Autogenou	•									
	1 -	ynthesis. protein	-								
		ar trafficking, post	translational								
IV	modification	<u> </u>	alamin are et	10	V ec =1	da (	. ~	tic :			
11		gineeringprinciples,		10	Knowle	age of	gene	tic er	iginee	ring.	
	1	esinvolvedinrDNAt ons,intellectualprop									
		ons,menectualprop Ibiosafetyissuesasso									
	_	ofDNAmarkersing									1,2
		genomeanalysis,ger									
	1 *	diagnostics,anddiag									
	nGenome 1	-									
V		y engineered plan	ts, Chimeric	7	To unde	rstand	Con	cepts	of		1,2

	DNA, DNA probes and Genomic /c DNA libraries, chloroplast engineering, and transplastomic plants. Techniques for identification of diseased gene and		genetically engineered plants.	
	insertion into host cell.			
Pract	1. DNA isolation, quantification and	30	Able to explain and demonstrate,	
ical	electrophoresis.		different techniques of	
	2. RNA isolation, quantification and		biotechnology.	
	electrophoresis.			1,2,
	3. PCR reaction and gelelectrophoresis.			3,4
	4. Protein isolation and gelelec			
	trophoresis.			
	5. Restriction digestion and mapping.			

- T1. Elements of Biotechnology-P.K Gupta, Rastogi Publication.
- T2. Biotechnology and Genomics-P.KGupta, Rastogi Publications.
- T3. Lab Manualon Biotechnology-P.M.Swamy, Rastogi Publications

#### **Reference Books**

- R1. B.M.Turner, Chromatin & Generegulation, 1st Edition, Wiley-Blackwell, 2002.
- R2. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.
- R3. Lodishetal., Molecular cell Biology, 4th Edition, W.H. Freeman & Company, 2000.
- R4. The Cell: A Molecular Approach by Geoffrey M.Cooper, Robert E.Hausman.
- R5. Molecular Cell Biology by LodishH., BerkA, Kaiser C., KReigerM., BretscherA., PloeghH., Angelika Amon A., Matthew P. Scott M.P.

### **Other Learning Resources:**

https://link.springer.com/journal/11103

https://www.sciencedirect.com/journal/molecular-plant

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe DNA structure, replication, and sequencing principles.	1,2,7							
2	Describe RNA structures, synthesis, processing including small RNAs.	1,3,6							
3	Explain hormones, receptors, signalling, chemotaxis.	1,2,4							
4	Explain the application of genetic engineering.	1,3,7							
5	Describe the process of creation of genetically engineered plants.	1,3,4							

			SEMESTER – 1										
	se Title		natomy, Micro				_						
Cour	se code	24MSBO216R		credits:		L T	P		R O/F				
D		NE	Total hou			3 0	2	0 ( Nil	0 0	4			
	requisite gramme	Nil	Master of S	requisite				NII					
	nester	Fall/ III				σramm	e						
		I .	III semester of second year of the programme the structural and functional development of cells and tissues.										
Course		2. To make learner unders			_								
		growth in dicots and mono		romor					2000	1001)			
		3. To impart concept of mi		and evo	olution.								
(	C <b>O</b> 1	Describe meristems, vaso				factor	s af	fectir	ng cai	nbial			
		activity.		-,	·J F				-6				
	CO2	Y	ues its origin, structure, development, and ontogeny, compare										
		reaction wood, distinctions between heartwood and sapwood, and identify and classify											
		the plant specimen by asse			-			,		,			
	CO3	escribe leaf ontogeny, vascular tissue development, and calculate plastochronic index,											
		and describe transfer cells,		_			_			,			
	CO4	Prepare specimens using r			•					, and			
assess.									•				
(	CO5	Explain the theories of evo	lution.										
Unit-		Content		СН	Lea	rning (	Outco	me		K			
No.										L			
I	Meristen	ns-characters, classific	ation and	10	Able to o	describ	e an	d ex	plain				
	theories-	-Apical cell theory,	, Tunica-		about plan	nt cell	stru	cture	and				
	Corpusth	neory and Korper-Kapp	pe concept.		functions.					1,			
	Vascular	Cambium–Types,	divisions,							2			
	_	nent and seasonal activ	vity, Factors										
	_	cambial activity											
II		Structure, development and		8	Able to o				_				
	1 -	nd phloem. Reaction wood-			about stru		of c	ondu	cting	1,			
		es. Heart wood and sapw	-		tissues in p	plants.				2			
		grains, texture and defects											
		ry growth in Dicots and Mo		1.0	77 1 1	0.1			<u> </u>				
III		geny-initiation, apical,	intercalary,	10	Knowledg			and	tloral				
	_	andadaxial growth, plate			anatomy o	t plant	S.						
	_	ment of vascular tissues								1,			
		ransfer cells–Structure, dev s. Classical concept of fl	_							2			
		and its role in classification											
	types.	and its fore in classification	ii. Fiaiit gaiis,										
IV		on, squash and clearing	techniques	10	Able to o	leccrib	a an	d ev	nlain				
1,		preparation for light	-	10	about the				_				
	_	ation of fixatives, formu			hand clear				quus	1,			
		on for light microscop			inana cicai	5				2			
	dehydrat		procedures.										
	1	nes: Rotary, sliding, cryosta	•										
V		evolution, Darwinism, La		7	To unders	tand Co	once	otsof	•	1,			
	Neo Dar		,		evolution		_			2			
Pract		of anomalous secondar	y growth of	30			xpla	in	and	1,			
ical		families of Angiosperms.	, , , , , , , , , , , , , , , , , , , ,		demonstra		1		erent	2,			
	Ī	<i>U</i> 1			l								

2. Preparation of microtome block, Preparation	techniques of anatomy	and	3,
of permanent slides by the process of microtome	micro technique.		4
technique			

T1. Cutler, D.F.1978, Applied plant Anatomy, Orient Longman Publishers, New Delhi.

T2. Easu, 1987. The Anatomy of seed plants. Wiley Eastern Ltd., New Delhi.

### **Reference Books**

R1. Fahn, A.1989 Plant Anatomy, Pergamon press, Oxford, New York.

### **Other Learning Resources:**

https://www.cell.com/trends/plant-science/abstract/S1360-1385(01)02050-7 https://shop.elsevier.com/books/integrative-plant-anatomy/dickison/978-0-12-215170-5

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe meristems, vascular cambium, their types and factors	1, 2, 6						
1	affecting cambial activity.							
	Explain vascular tissues its origin, structure, development, and							
2	ontogeny, compare reaction wood, distinctions between heartwood	1, 2, 3, 6						
	and sapwood, and identify and classify the plant specimen by							
	assessing their anomalous secondary growth.							
	Describe leaf ontogeny, vascular tissue development, and calculate							
3	plastochronic index, and describe transfer cells, floral anatomy, and	1, 2, 6						
	explain its role in classification.							
4	Prepare specimens using microtome, maceration, squash, and	1, 3, 6						
4	clearing techniques, and assess.	, ,						
5	Explain the theories of evolution.	1, 2, 6						

	SEMESTER - IV									
Course Title		Research/data ana	alysis/	docur	nentat	ion-R	4			
Course code	24MSBO221R	<b>Total credits: 13</b>	L T P S R O/F C					C		
		Total hours: 40P	0	0	20	8	6	0	13	
Pre-requisite	Nil	Co-requisite	Nil							
Programme	Master of Science in Botany									
Semester	'	Winter/II semester of First year of the programme								
Course	1. To determine v	whether the objectives	of rev	view o	of litera	ture g	gap	analysi	s have been	
objectives	met, if not what st	eps can be taken accord	dingly							
CO1	Create and imple	ement a plan to bridge	the ga	p						
CO2	Find the gap and e	evaluate solutions.								
CO3	Identify the ideal	future state/action plan								
CO4	To analyse the cur	rent state/work of research	arch							
CO5	To implement the	strategies to meet the r	esearc	ch gap	under	super	visio	n.		

			SEMI	ESTER – IV									
Cou	ırse Title			Angiospern	n taxon	omy-I							
Cou	ırse code	24MSBO222R		credits: 4	L	T	P	S	R	O/F	C		
				irs: 45T+30P	3	0	2	0	0	0	4		
	-requisite	Nil		requisite				Nil					
	gramme			Master of Sci			•						
	emester			emester of Fin						• • • •	. ,		
Course	e Objectives	1. To study the fun identification.	idamental	concept of H	owerin	g plan	ts Ior	prop	er clas	ssificati	ion and		
			atudanta ta	study the fla	ouvonin.	a nlant	G 012	1 idan	tify m	n to the	2 000110		
		2. Field visit help s level.	students to	study the m	owering	g piam	is and	ı idei	uiiy u	pioine	genus		
			d students	can gather l	znosvle	dae ab	out t	ha at	hnobo	tanical	use of		
		3. By visiting field students can gather knowledge about the ethnobotanical use of plants by local people.											
		4. To learn about the herbarium process, students visit research organisations like											
		BSI, NBRI, FRI and can gather knowledge.											
		5. Students can apply for research fellowships for Ph.D. and other higher degrees in											
		plant taxonomy in universities.											
	CO1	Explain the princip			identifi	cation	of n	ants					
	CO2	Describe botanica							com	puter-s	assisted		
	-	identification.	<b>-</b> , 2, 0	II		11100	-2-40	,	2 311	1			
	CO3		Explain botanical nomenclature principles, rules, priority, effective publication, and										
		related terms.		1 1	,	<i>,</i> 1	<i>J</i> ,		1		,		
	CO4	Prepare herbarium,	discuss b	otanical gard	lens, li	braries	, and	the 1	Botani	cal Su	rvey of		
		India, their signific		_			,				J		
	CO5	Explain OTUs,					meas	sures,	clus	ster a	nalysis		
		dendrogram/ clado		•							-		
Unit-	Content			СН	Learn						KL		
No.													
I		Taxonomy: Aims, o	-	10	Know	_		of		ferent			
		les. Pre and Post D						tems	and co	oncept			
		ons, Phenetic, Phylo			of cha	racters	S.						
		nd APG System, A	-										
	Omega	<b>3</b> /	xonomic										
	1	Concept of species									1.0		
		l infra-specific ca	_								1,2		
	1 -	of Characters—Qu											
	_	tative characters, G											
		ters, analytical and so conservative character	•										
	1	conservative characters, Isolat											
		of characters.	aliu										
II	_	Faxonomy: Botanio	ral kevs-	8	To le	arn the	hac	ics of	- tayo	nomy,	-		
		keys, multi-acces	-				otani		keys	and			
	_	pattern recognition	-		taxono				110 9 5	unu			
	-	ication Punched Ca	-		watom			<b>-</b> ·					
		literature-Preparat	-										
		n of data in floras,									1,2		
	-	a, manuals, mon											
	-	icons, journals and											
		an noted list, rev											
		puter in identification	-										
L	J /										1		

III	Deterior Nomenalature, Driveiules	10	To 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	
1111	Botanical Nomenclature: Principles	10	To know about the nomenclature	
	and major rules, typification, rule of		of plants.	
	priority, effective and valid			
	publication, retention, choice and			
	rejection of names, illegimate names,			1,2
	Authors' citation, synonym, basionym,			1,2
	nomina conservenda, St. Louis			
	Code, Biocode, nomennudum,			
	tautonym, later homonym, Names of			
	hybrids, Names of cultivated plants.			
IV	Herbarium techniques: Methods of	10	To understand the basics of	
• '	Collection, Identification and	10	herbarium techniques, function of	
	·		_	
	Documentation. Role and importance		botanical gardens and BSI.	
	of herbaria. Kinds of herbaria.			
	Important herbaria in the world and			
	India. Virtual Herbarium. <b>Botanical</b>			1,2
	Gardenmuseums and Botanical			
	<b>library-</b> Function and role			
	intaxonomic studies. Botanical			
	Survey of India: Organization,			
	activities and publications.			
V	Taxometric-Principles, OTUs,	7	Able to describe and explain	
	character coding, measure of		about the principle and	
	resemblances, cluster analysis,		applications of taxometric.	
	commonly available software,		approducing of tunionicality	
	construction of Dendrograms and			1,2
	cladograms, basic of bio informatics,			
	biological databases, data search,			
-	sequencing methods.	20		
Pract	1. Field excursion (5-7 days) to the	30	Describe, illustrate and explain	
ical	neighbouring states of Assam/NE		and apply taxonomic tools to	
	India, making collection of angiosperm		solve critical problems related to	
	plant species and describe the		identification and nomenclature of	
	specimen using botanical terms and		plant species.	
	keying out the prominent characters for			
	identification up to the rank of species			
	for the preparation of a flora. (Students			
	are required to submit at least 25			
	herbarium /museum specimens).			
	2. Basing on collection of locally			1,2,
	available angiospermic plants, students			3,4
	may be assigned to study any one of			
	the following branches in relation to			
	angiosperm taxonomy-(a) External			
	1			
	morphology, (b) Anatomy, (c)			
	Cytology, (d) Palynology (e)			
	Chemotaxonomy.			
	3. Practices on Nomenclatural			
	problems by handling of floras,			
	manuals, icons and index kewensis etc.			
	4. Handling of taxonomic softwares.			
L				

- T1. A HandBook of Field and Herbarium Methods. Today and Tomorrow Publications, New Delhi. Jain, S.K. and Rao, R.R. Publications, New Delhi.
- T2. Advanched Plant Taxonomy. Mondal, A.K.Central BookAgency, Kolkata.
- T3. An Introduction to Angiosperms, N.C.Kumar, Himalaya Publishing House, 1995.
- T4. Evolution and Classification of Flowering Plants. Cronquist, A.New York Botanic Gardens, Bronx, New York.
- T5. Evolution and Phylogeny of flowering plants; Hutchinson, J. Academic Press, London & New York.
- T6. Taxonomy of Angiosperms. Naik, V.N. Tata McGraw Hill, New Delhi.
- T7. The families of flowering plants: Hutchinson, J.Oxford University Press.
- T8. The geography of flowering plants. Good, R. Longman, London.
- T9. The Plant Book. Moberly, D.J. Cambridge University Press, London.

#### Reference Books

- R1. Genera of flowering plants. Hutchinson, J. Cambridge University Press, London.
- R2. Greuter.W.etal. Scientific Books, Konigstein.
- R3. International Code of Botanical Nomenclature. St.Louis Code. Koeltz.
- R4. Introduction to the principles of plant taxonomy. Sivarajan, V.V.and Robinson Oxford IBH.
- R5. Modern Plant Taxonomy, N.S, Subrahmanyam, Vikas Publishing house Pvt.Ltd, Noida, 2008.
- R6. Origin and dispersal of Flowering Plants. Takhtajan, A.
- R7. Plantsystematics, Singh, Gurcharan: Oxford IBH

### **Other Learning Resources:**

https://www.sciencedirect.com/journal/plant-Diversity

https://www.sciencedirect.com/journal/perspectives-in-plant-ecology-evolution-and-systematics

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the principles, classifications and identification of plants.	1, 2						
2	Describe botanical keys, taxonomic literature methods, and	1, 2, 6						
	computer-assisted identification.	1, 2, 0						
3	Explain botanical nomenclature principles, rules, priority, effective	1, 2, 6						
	publication, and related terms.	1, 2, 0						
	Prepare herbarium; discuss botanical gardens, libraries, and the							
4	Botanical Survey of India, their significance in knowing plant	1, 3						
	species.							
	Explain OTUs, character coding, resemblance measures, cluster							
5	analysis, dendrogram/ cladogram construction, bioinformatics, and	1, 2, 6						
	sequencing methods.							

	SEMESTER – IV										
	urse Title			giospe						T	
Cor	urse code	24MSBO223R	Total credit		L	T	P	S	R	O/F	C
	• •,	NT'91	Total hours:		2	0	0	0	0	0	2
	-requisite	Nil	Co-requisi			. : D.	.4	Ni	l		
	ogramme			ster of S			•				
	emester e Objectives		Winter/II seme							14.	(-viv-1
Cours	e Objectives	1. To study the plant morphology student will be benefitted to identify plants (visual identification) properly. Proper identification and classification are important in									
		, <u>, , , , , , , , , , , , , , , , , , </u>									
		the fields like genetics, ecology, physiology, Embryology etc.									
		2. To study all the applied disciplines of plant sciences such as Agriculture,									
		Horticulture, Forestry, Pharmacognosy, Biotechnology, etc.									
		3. By studying phytogeography students can able to know about the differences of									
		plants pecies in different geographical zones.									
		4. By studying forest types students can able to know about the different plant									
		species distributed in different types of forests.									
	CO1	Describe taxonom			lar tax	onom	y, diag	gnostic	tools	, PCR a	nalysis,
		and applications of									
	CO2	Explain angiosper	-		ics, ar	nd evo	olution	, as w	ell as	ethno bo	otanical
		uses concerning N									
	CO3	Describe North East India's flora, endangered plant conservation, and sustainable									
		forest management.  Explain phytogeography, India's biodiversity, migration, and plant domestication.									
	CO4				•	_		•			
	CO5	Explain phylogeny		n of A	ngiosp	ermio	e taxa,	cove	ing ke	ey dicoty	yledons
		and monocotyledo	ns.								
Unit-	Content			СН	Lear	ning (	Outcon	1e			KL
No.	Carrage	of taxonomic		10	V	11 -	f	1:66			
1	Sources		<b>evidences:</b> Palynology,	10		_				onomic	
	Morphology E	y, Anatomy, mbryology, Cytolo	, ,,		evidences for proper identification and classification of angiosperms.						
		nomy, Phytochemia			and C	145511	Icatio	.1 01 a1.	igiospe	511118.	
		tics, Numerical									1,2
	1	plant taxonomy,	• ,								1,2
	tools, PC	-	diagonostic plication of								
		narkers in plant tax	•								
		ince of molecular tax									
II	_	nd evolution-	Origin of	8	Knov	wleda	e of r	robah	le orio	gin and	
11		s with special refe	$\mathcal{E}$			_	of ang		•	5111 GIIG	
		s with special fele tock, Characteristic			CVOIL	411OII (	or ang	iosper	1113.		
	Primitive	and advanced	angiosperms,								
		y trends in Angios	•								1,2
	of flowering		perms. Craule								1,2
	1	ny-Use of plants	by the tribal								
		in North-Eastern	•								
	subsistence, medicine and cultural purposes										
III					To k	now	about	the fo	rest t	ypes of	
		India, RET plants		10	Nort			India	and	their	
		rence to NE India.					on stra			шеп	
	•	er plants and the			201130	or vail	on 5016	gics	•		1,2
	_	exotic, alien and									
		North East flora.									
	Cicinents III	TAOLUI Last Hora.	DIO diversity								

	assessment and magnitude, use of GPS and GIS. Conservation and Utilization of forest resources.			
IV	Phytogeography -Concept, Static and Dynamic Phytogeography, Phytochoria and botanical provinces of India; Major theories, Ranges, Migration and Barriers, Vicariance biogeography, Endemism, IUCN categories, Hotspots, India as a mega diversity country. Plant introduction and plant domestication, Patterns of geographical distribution, Centre of Origin.	10	To understand the basics of phytogeography and IUCN.	1,2
V	Phylogeny and evolution of angiospermic taxa- Dicotyledons: Magnoliales, Ranunculales, Lamiales, Asterales, Malvales, Fabales, Scrophulariales, Caryophyllales, Monocotyledons: Arales, Orchidales, Poales, Cyperales, Zingiberales.	7	Able to describe and explain about the principle and applications of taxometric.	1,2

- T1. Evolution and Phylogeny of flowering plants; Hutchinson, J. Academic Press, London & New York.
- T2. Genera of flowering plants. Hutchinson, J. Cambridge University Press, London Greuter. W. et al. Scientific Books, Konigstein.
- T3. International Code of Botanical Nomenclature. St.Louis Code. Koe.
- T4. Introduction to the principles of plant taxonomy. Sivarajan, V.V. and Robinson Oxford IBH.
- T5. Modern Plant Taxonomy, N.S, Subrahmanyam, Vikas Publishing house Pvt. Ltd, Noida, 2008.
- T6. Origin and dispersal of Flowering Plants. Takhtajan, A.
- T7. Plant Systamatics: Theory and Practice. Gurcharan Singh, 2004. Oxford & Ibh Publishing Co.P.Ltd., New Delhi.
- T8. PlantTaxonomy, N.B. SaxenaandSaxena, PragatiPrakashan, Meerat, 2010.
- T9. TaxonomyofAngiosperms, V. SinghandD. K. Jain, RastogiPublication, Meerat 2005.
- T10. Taxonomy of Angiosperms. Naik, V.N.Tata McGraw Hill, New Delhi.
- T11. The Plant Book. Moberly, D.J. Cambridge University Press, London.

#### Reference Books

- R1. Origin and dispersal of Flowering Plants. Takhtajan, A.
- R2. Plant Systamatics: Theory and Practice. Gurcharan Singh, 2004. Oxford & Ibh Publishing Co.
- P.Ltd., New Delhi.
- R3. Plant Taxonomy, N.B.Saxena and Saxena, Pragati Prakashan, Meerat, 2010.
- R4. TaxonomyofAngiosperms, V. Singhand D.K. Jain, Rastogi Publication, Meerat 2005.
- R5. Taxonomy of Angiosperms. Naik, V.N.Tata Mc Graw Hill, New Delhi.
- R6. The Plant Book. Mabberley, D.J. Cambridge University Press, London.

#### **Other Learning Resources:**

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/phytogeographyhttps://link.springer.com/chapter/10.1007/978-90-481-8725-6_4

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe taxonomic evidences, molecular taxonomy, diagnostic tools, PCR analysis, and applications of molecular markers.	1, 2				
2	Explain angiosperm origin, characteristics, and evolution, as well as ethno botanical uses concerning North-East tribes.	1, 2, 6				
3	Describe North East India's flora, endangered plant conservation, and sustainable forest management.	1, 2, 6				
4	Explain phytogeography, India's biodiversity, migration, and plant domestication.	1, 3				
5	Explain phylogeny and evolution of Angiospermic taxa, covering key dicotyledons and monocotyledons.	1, 2, 6				

			SEMESTER – IV							
Co	urse Title		Microbio	ology-I						
Co	urse code	24MSBO222R	Total credits: 4	L	T	P	S	R	O/F	C
			Total hours: 45T+30P	3	0	2	0	0	0	4
	-requisite	Nil	Co-requisite				Nil			
	ogramme	7	Master of Scient							
	emester		Vinter/II semester of First with the microbial ecol						nieme ir	, soil
Cours	e Objectives	water and air.	with the inicrobial ecol	iogy, c	iiveisi	ty or	IIIIC	ioorga	111151115 11	I SOII
			understand about the app	nlicatio	on of r	micro	การล	nisms	in agric	ulture
		and industry.	anderstand about the app	pireatr	on or i	incic	orga	11131113	in agric	unun
		1	with microorganisms inv	olve i	n the fo	ood i	ndust	rv.		
	CO1		nteractions, microbes in e							
	CO2		eteristics, isolate, identif					resent	soil, ai	r and
			rate the method of bacte	•	•		•			
		activity of microbes								
	CO3	Describe microbial	application in agriculture	for cr	op pro	ducti	on.			
	CO4	Describe microbial	application in industr	ry inc	luding	pha	rmac	eutica	ıls, food	l and
		beverage and bio fu	el industries.							
	CO5	Describe food micro	biology, food safely, pre	preservation, and quality of pro-			of products.			
Unit-		Content	t	СН		Lear	ning	Outco	me	K
No.	Microbial	Ecology-Interaction	on among microbial	10	Knov	wlad	70 (	of m	icrobial	L
1		••	on among microbial etion with plants and	10	inter		-	with	other	
			with xenobiotics and		orgai			VV ILII	Other	1,2
	inorganic	pollutants, Micr			Organ	1113111	٠.			1,2
	vironment	•								
II			diversity in soil, soil	8	То	learr	the	e bas	sics of	
		<i>C.</i>	composition of organic		micro	obial	dive	ersity	in soil,	
	matter, me	ethods to detect and	quantify soil microbes,		wate	r and	air.			
	soil met g	genomics, biosensors	to monitor soil health							
	and toxici	ty.								
	Airmicrob	oiology- Phyllosphe	ere and phylloplane,							1,2
	distributio	n of microbes in Ai	r, allergic disorders by							
	air microf	lora, sampling techni	iques,							
	Water mid	crobiology-Microbia	l components of water,							
			er in municipal water							
		cteriological analysi								
III		••	griculturally Important	10	To .	kno		abou		
	microbes,	2			agrıc	ultur	al mi	crobic	ology.	
			cosphere, Mycorrhiza,							1,2
		•	caused by different							
IV		, Bio-control of plan		10	Torr	ndor	etond	tha h	asics of	
1.4		= -	ustrial importance of	10				obiolo		
		organisms, Fern	• .		maus	suial	mul	551010	, e j ·	
bioreacto			preservation and							
			nicrobes, downstream							1,2
	processin	-	protein, Industrial							
	_	=	, antibiotics, ethanol,							
	vitamins	and amino acids.								

V	Food microbiology- Fermented food (milk, meat,	7	Able to describe and	
	vegetables, beer, wine and vinegar), Food spoilage		explain about the	1,2
	and preservation, Food borne diseases.		applications of microbes in	1,2
			food and dairy industry.	
Pract	1. Isolation of specific microorganisms using specific	30	Describe, illustrate and	
ical	media. Study of micro flora from the rhizosphere of		explain and apply microbial	
	agriculturally important crop. Study the spore and		tools and techniques for	
	mycelia of different fungus and their morphological		solving microbiological	
	identification. Mycorrhiza- spore population and root		problems.	
	colonization.			
	2. Assessment of antimicrobial activity of microbes			1.0
	against plant pathogens.			1,2
	Bacteriological analysis of water			,3, 4
	3. Detection of organic acids produced by fungi by			7
	paper chromatography method.			
	4. Biochemical tests for identification of bacteria			
	(catalase, IMViC, oxidase, etc.).			
	5. Field excursion (5-7 days) to the neibhouring states			
	of Assam/ NE India to visit different research,			
	educational institute, industry etc.			

- T1. Textbook of Microbiology by Ananthanarayan and Paniker.
- T2. Microbiology by Lansing MPrescott, Donald A Klein, John P Harley, Mc Graw Hill.

### **Reference Books**

- R1. Microbiology: Principles and Explorations by Jacquelyn Black7e, John Wiley & Sons, inc.
- R2. General Microbiology by Roger Y Stanier, John L Ingraham, Mark L Wheelis, 5th edition Tata Mac Graw Hill.

### **Other Learning Resources:**

https://www.sciencedirect.com/bookseries/progress-in-industrial-microbiology/vol/31/suppl/Chttps://www.sciencedirect.com/topics/agricultural-and-biological-sciences/industrial-microbiology

CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Explain the principles, classifications and identification of plants.	1, 2, 3, 6			
2	Describe botanical keys, taxonomic literature methods, and computer-assisted identification.	1, 3, 4, 6			
3	Explain botanical nomenclature principles, rules, priority, effective publication, and related terms.	1, 2, 3, 6			
4	Prepare herbarium, discuss botanical gardens, libraries, and the Botanical Survey of India, their significance in knowing plant species.	1, 2, 3, 6			
5	Explain OTUs, character coding, resemblance measures, cluster analysis, dendrogram/ cladogram construction, bioinformatics, and sequencing methods.	1, 2, 3, 6			

			SEMESTER	R – IV								
Cou	ırse Title				iology.	-II						
Cou	ırse code	24MSBO223R	Total credits: 2	L	T	P	S	R	0	/F	C	
			Total hours: 30T	2	0	0	0	0	(	0	2	
	-requisite	Nil	Co-requisite					Nil				
	gramme	-										
	emester	4 501 4	Winter/II semeste									
Course	e Objectives		<ol> <li>The course deals with the microbial growth and microbial genetics.</li> <li>To make learner understand about genetic recombination, microbial biotechnolog</li> </ol>									
				_	etic rec	combin	iation,	micro	biai t	oioteci	inology	
		_	and concept of genetic engineering.  3. To impart method of control of microorganisms.									
	CO1	_			-		1	1 4 . 1.	14			
	CO2		robial growth patter								:	
	CO2		ial genetics, encomp	_	•							
		<u> </u>	processes, and fun	aamen	itai as	pecis	01 D	NA, K	ανΑ,	and	proteir	
	<u>CO2</u>	synthesis in mic		-1v1		ation .	- d				nylation	
	CO3	in bacteria.	ic recombination, m	orecul	ar gen	cues, a	ına ge	ne exp	oress1	ion reg	guiaiior	
	CO4		aial hiotaahmalaa	genet:	0.000	incomi	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	d oppl	ionti	on of	ganati	
	CU4	_	pial biotechnology,	geneti	e engi	meerm	g, an	u appi	ıcatıc	on of	genenc	
	CO5	engineering.	ods for controlling n	nioroo-	anian	ne ro1	a of o	ntibiati	og c	nd cho	110000	
	COS		drug resistance in ba		-	115, 101	c or a	เนบเบเ	ics, a	nu Cilă	menges	
Unit-	Content	related to multi-	urug resistance in ba	CH		ning O	utcom	Δ			KL	
No.	Content				LCari	inig O	uttom				KL	
I	Microbial	Growth-Defini	tion of growth,	10	Knov	vledge	of r	nicrobi	ial g	rowth		
			ions and growth			growth			J			
	curves,	Mathematical	expression of									
	exponentia	l growth phase	, Measurement of								1,2	
	growth an	nd growth yie	elds; Synchronous									
	growth;	Continuous cu	lture, Effect of									
	environme	ntal factors on g	rowth.									
II	Microbial	Genetics-		8	To learn the basics of r			mic	robial			
	Geneticma	terials,nuclearD	NA,chloroplastDN		genetics and genetic materials.							
	A,mitocho	ndrialDNA,plası	nids,inheritanceoft						1,2			
	· ·	-	genetransfer,genesa								1,2	
		omes,DNArepli	cation,RNAand									
	protein syn											
III	Genetic	recombination		10				ne fore				
			nation in bacteria,			n- ea			and	their		
			e genetic elements,		conse	ervatio	n strat	tegies.				
		_	Operon concept,								1,2	
	promoter,											
		-	g (RNA capping,									
		il formation, RN	2	10								
IV			or human welfare,	10		unders			basic			
		and genomic	DNA library,		micro			echnolo	ogy	and		
	_	-	g, expression of		genet	tic eng	ıneeri	ng.				
	cloned		etherapy, DNA								1,2	
			plication of RNAi									
	technology	,	and siRNA) in									
	_	and medical sci										
	Geneuc en	igineering – too	ls and techniques,	<u> </u>							<u> </u>	

	manipulation of natural genetical processes in biotechnology, restriction enzymes and ligases, cloning and expression vectors (plasmid, Tiplasmid, cosmid, fosmid, BAC, YAC and PAC).			
V	Control of micro organisms: Physical, chemical and biological, Antibiotics, modeo faction of antibiotics, multi drug resistance in bacteria.	7	Able to describe and explain about the control of microorganisms and conrol action.	1,2

- T1. Textbook of Microbiology by Ananthanarayan and Paniker.
- T2. Microbiology by Lansing MPrescott, Donald AKlein, John PHarley, Mc Graw Hill.

### **Reference Books**

- R1. Microbiology: Principles and Explorations by Jacquelyn Black7e, John Wiley & Sons, inc.
- R2. General Microbiology by Roger Y Stanier, John LIngraham, Mark LWheelis, 5th edition Tata Mac Graw Hill.

### **Other Learning Resources:**

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/soil-microbiology https://www.sciencedirect.com/topics/immunology-and-microbiology/microbiology

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Explain the microbial growth pattern, continuous culture and batch culture.	1, 3, 6				
2	Explain microbial genetics, encompassing genetic materials, inheritance mechanisms, gene transfer processes, and fundamental aspects of DNA, RNA, and protein synthesis in microorganisms.	1, 2, 3				
3	Describe genetic recombination, molecular genetics, and gene expression regulation in bacteria.	1, 2, 3				
4	Explain microbial biotechnology, genetic engineering, and application of genetic engineering.	1, 2, 3, 6				
5	Describe methods for controlling microorganisms, role of antibiotics, and challenges related to multidrug resistance in bacteria.	1, 2, 3, 6				

			SEMESTER – IV								
	rse Title	2414CD0222D		Ecolog	•			ъ	0/5		
Cour	rse code	24MSBO222R	Total credits: 4 Total hours: 45T+3	30P 3	T 0	P 2	S 0	R 0	0/F 0	C 4	
Pre-i	requisite	Nil	Co-requisite	501 3	U		Nil	U	U	<u> </u>	
	gramme	1									
	mester	Winter/II semester of First year of the programme									
Course	Objectives	1. To study the detail	To study the detail about Plant Population and Plant community.								
		•	. To study about Ecosystem stability, Ecosystem degradation and its consequence							es.	
		3. To study the different techniques of bio waste and e-waste management.									
	C <b>O</b> 1	Describe System Ec	ology, Evolutionary	y Ecol	ogy, St	atistic	al Eco	ology	and r	elated	
	204	branches.									
(	C <b>O2</b>	Explain characteristi	* *			•	_			•	
		processes, complex r	elationships with ot	ther or	ganisms,	, patte	rns of	devel	opmei	nt and	
	CO3	diversity.  Explain the ecologi	cal parturbations (	(noturo	1 and	onthro	nogen	ia) bi	io ro	COURGO	
	_ <b>U</b>	sustainability, protect	•	`				, U	10 16	source	
(	C <b>O</b> 4	Describe vegetation d						on and	l chan	ges in	
		ecosystem properties.							11411	III	
	C <b>O</b> 5	Describe bioremediat		on, bio	degrada	tion a	nd eco	logical	l tech	niques	
		for bio waste and e-w	aste management.							•	
Unit-				СН	Learnii	ıg Out	come			KL	
No.	<b>D</b> 1			1.0	77 1						
I		nent of ecology in Indi	1	10	Knowl	_		_	gical		
		nes, evolutionary eco			develo	oment	in Ind	ıa.			
	Principle	gical factors in the spertaining to 1	imiting factors.								
		on and elements of									
			nceptual model,							1,2	
		nodel, auxiliary varia	•								
	_	Basic concepts to st									
	fundamen	tal knowledge on	pattern analysis,								
		alysis and ordination.									
II	_	n concepts-character	*	8				pasics	of		
		ntrol. Mechanisms	* *		popula		conc	epts	in		
	regulation	· •	• 1		ecolog	у.					
	population	•	lysis. Species								
		ns -types of interaction, herbivory, carniv	-							1,2	
	_	y, weed-cropinter fer	* *							1,4	
	_	-	and dispersal,								
	interdemi	-	age structured								
		ns. Ecological amplit									
		aptation - ecads, eco types, eco species.									
III				To kno			e stab	ility			
		); ecological perturbat	,		in ecos	ystem	•				
		genic) and their impa	-							1.0	
	-	ems; ecology of	_							1,2	
		its importance & be									
	communi	on and its consequen by and continuum	-								
	Communi	y and continuum	, analysis of								

	communities (analytical and synthetic			
	characters); community coefficients; inter			
	specific associations; ordination; concept of			
	ecological niche, species diversity $(\alpha, \beta, \gamma)$ .			
IV	Vegetation development, temporal changes	10	To understand the ecological	
	(cyclicandnon-cyclic); mechanism of ecological		succession.	
	succession (relay floristics and initial floristic			1,2
	composition; facilitation, to lerance and			1,2
	inhibition models); changes in eco system			
	properties during succession.			
V	Bioremediation, biotransformation,	7	Able to describe and explain	
	biodegradation and phytoremediation, Insituand		about the	
	Ex-situpractices. Use of microbes (algae,			
	bacteria and fungi) and plants to check			1,2
	biodegradation, biotrans for mation; waste water			1,2
	treatment using a quaticplants; root zone			
	treatment. Ecological techniques for biowaste			
	and e-waste management.			
Pract	1. Estimation of above ground and below ground	30	Describe, illustrate and	
ical	biomass from unit area.		explain and apply ecological	
	2. Effect of biotic disturbances on botanical		methods of studying	
	composition.		ecosystem.	
	3. To study the similarity between plant			
	communities using index of similarities and			
	dissimilarities.			
	4. To study primary productivity for herbaceous			
	community by Harvest method; Leaf Area Index			
	and anatomic aladaptive features of plants.			
	5. Field excursion to the neibouring states of			
	Assam/ NE India for ecological study of			1,2,
	different vegetation pattern.			3,4
	6. Plant Geography: To study the distribution of			
	vegetation type of India			
	7. To study the vegetation type of North east			
	India			
	8. To plot Biosphere Reserves/ Ramsarsites/			
	National Parks/ Wildlife Sanctuaries located in			
	different biogeographical zones of India.			
	9. To plot Biosphere Reserves /Ramsarsites			
	/National Parks /Wild life Sanctuaries located in			
	NE India			
	10. Study of dispersal mechanism of seeds in			
	plants pecies.			

- T1. Freeman, B. (ed.), 1995.-Environmental Ecology-The ecological effects of pollution, disturbance, and other stresses. Academic press.
- T2. Michael, P.1990.-Ecological methods for field and laboratory in vestigations. Tata Mc Graw Hill, New.

### **Reference Books**

- R1. Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
- R2. Smith, R.L. (1996), Ecology and Field Biology, Harper Collins, New York.
- R3. Townsend, C.R., Begon, M. and Harper, J.L. 2003. *Essentials of Ecology*. Second Edition. Black well Publishing, Oxford.

# **Other Learning Resources:**

 $\frac{https://www.sciencedirect.com/topics/earth-and-planetary-sciences/plant-ecology}{https://link.springer.com/journal/11258}$ 

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe System Ecology, Evolutionary Ecology, Statistical Ecology and related branches.	1, 2, 3, 6				
2	Explain characteristics of population and community, regulation of ecosystem processes, complex relationships with other organisms, patterns of development and diversity.	1, 2, 3, 6				
3	Explain the ecological perturbations (natural and anthropogenic), bio resource sustainability, protect and conserve nature and analyse communities.	1, 3, 6, 7				
4	Describe vegetation development, mechanism of ecological succession and changes in ecosystem properties.	1, 3, 6, 7				
5	Describe bioremediation, biotransformation, biodegradation and ecological techniques for bio waste and e-waste management.	1, 3, 6, 7				

	SEMESTER – IV									
	ırse Title			t Ecolog	-				1	
Cou	ırse code	24MSBO223R	Total credits: 2	L	T	P	S	R	O/F	C
	• •,	71.1	Total hours: 30T	2	0	0	0	0	0	2
	-requisite	Nil	Co-requisite	Caianaa	: D.4		Nil			
	gramme emester		Master of			•				
		1. To study the de	Winter/II semester of tail about Plant Popula							
Course	Cobjectives	1	Ecosystem stability, E				•		seguer	ices
			fferent techniques of b		_				_	iccs.
	CO1	· ·	al restoration, ecosyst							oraded
	001	ecosystem.	ar restoration, ecosyst	.0111 100	onstr <b>ac</b>	tion u	ia res	ioruiro	n or ac	Bradea
	CO2		mental management	susts	ainahle	deve	lonme	ent 6	environ	mental
	CO2	1 -	ply environmental im				_	C111, (		mema
	CO3		ology, different forest	•				nositio	n disc	uce the
	C03	1 -	ues of North East Indi		1 maia	, iores	t COIII _j	positio	ni, uisc	uss tile
	CO4		ensing and Geograph		format	ion Sv	stem	(GIS)	in eco	logical
		studies.	ensing and Ocograpii	iivai III	.v.mal	on by	J. C. 111	(010)	111 000	iogical
	CO5		ographical regions of	India '	Vegeta	tion tv	nes of	f India	Riodi	versity
		significance of NE			, 550ta	aon ty	P-0 01	maia	, Dioui	· · CIBILY
Unit-		Content		СН		Learn	ing Oı	ıtcome	<u>.</u>	KL
No.		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		011						
I	Concepts	of ecological res	storation, aims and	10	Knov	vledge	of o	concep	ots of	
	strategies;	ecosystem recons	truction, major tools		I	gical		_		
	used in	restoration, restor		strate	-					
	diversity-A	Acceleration of ec	ological succession,							1,2
	reintroduc	tion of biota; rest	oration of degraded							
	ecosystem	s - Forest, gr	assland and lake							
	including	contaminateds oils	, mines poils etc.							
II	Scope of	environmental	management, basic	8	Knov	vledge	of en	vironr	nental	
	concepts of	of sustainable deve	lopment, advantages		mana	gemen	t aı	nd i	mpact	
	of enviro	nmental monitorin	ng, deterioration of		mana	gemen	t.			
	environme	ental quality w	vith reference to							
	anthropog	enic impact; metho	ods of assessment of							1,2
			nort term studies/							1,2
	1	-	Continuous short-							
		0.0	eneral guidelines for							
	1 .		ironmental impact							
	statement.									
III	_		nanagement: Forest	10					pes of	
			f India; changes in		envir	onmen	tal ma	ınagen	nent.	
		-	Cover; issues and							
	_		fting cultivation and							
	industriali		•							1,2
			and from hills and							
issues rela		_	um and natural gas;							
		-	on of Ramsar sites of							
		India: Loktak lake	_	4.0						
IV	_		ncepts of remote	10		unders		the	basic	
	_		remote sensing in			ept a	_	rıncıpl	le of	1,2
	environm	ental studies: for	est survey, habitat		remo	te sens	ıng.			

	analysis, water management, welt and survey, rain fall estimation, pollution studies, soil conservation, vegetation mapping. Geographical Information System (GIS) - basic principles, techniques and importance. Global Positioning System (GPS): basic principles, Applications in ecological studies.			
V	Phytogeography: Phytogeographical regions of India, Vegetation types of India (vegetation of Western Himalayas, Eastern Himalayas, Assam, Gangetic plain, Indusplain, Malabar, Deccanetc, Bio diversity significance of NE region.	7	Able to describe and explain about the phytogeography and vegetation pattern of India.	1,2

#### **Text Books**

- T1. Misra, R.1968. -Ecology Work Book. Oxford & IBH, New Delhi.
- T2. Mukherjee, B.1996.-Environmental biology. Tata Mc Graw Hill Publ., New Delhi.
- T3. Bharucha, F.R.-A text book of plant geography. Oxford UniPress.
- T4. Cain, S.A. 1944.-Foundation of Plant Geography. Harper, New York.
- T5. Freeman, B.(ed.), 1995.-Environmental Ecology-The ecological effect of pollution, disturbance, and other stresses. Academic press.

#### **Reference Books**

- R1. Cain, S.A. 1944.-Foundation of Plant Geography. Harper, New York.
- R2. Freeman, B.(ed.),1995.-Environmental Ecology-The ecological effects of pollution, disturbance, and other stresses. Academic press.

#### **Other Learning Resources:**

https://www.nature.com/subjects/plant-ecology/ncomms https://link.springer.com/journal/11258

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe ecological restoration, ecosystem reconstruction and restoration of degraded ecosystem.	1, 3, 6					
2	Explain environmental management, sustainable development, environmental monitoring and apply environmental impact assessment methods.	1, 2, 3, 6					
3	Explain forest ecology, different forest types of India, forest composition, discuss the Environmental issues of North East India.	1, 3, 6					
4	Explain remote sensing and Geographical Information System (GIS) in ecological studies.	1, 2, 3, 6, 7					
5	Describe phytogeographical regions of India, Vegetation types of India, Biodiversity significance of NE region.	1, 3					

			SEMESTER – IV	V						
Cours	e Title		Plant Physiology	and B	iochem	nistry-l	[			
Cours	se code	24MSBO222R	Total credits: 4	I	T	P	S	R	O/F	С
			Total hours: 45T+30	)P 3	3 0	2	0	0	0	4
	quisite	Nil	Co-requisite				Ni	il		
	amme		Master of Sc							
	ester		/inter/II semester of Fi							
	urse		ne mechanisms of memb		anspor	t, wate	r pot	ential,	, minera	al
Obje	ctives	_	ir regulation in plant cel			1 1.		1 1 .		
			lge of nitrogen fixation,	nitrog	en meta	abolism	ı, and	a phoi	osyntn	esis in
		plants.	hygialagiaal progagge	nyolyo	d in fla	arronin (	r and	tha m	anlatic	n of
		fruit developme	hysiological processes i	nvoive	a m nc	wering	ganu	me re	eguianc	)II ()I
		1	ne plant's physiological i	resnon	ses to a	hiotic	stres	Ses		
			role and mechanisms of	_					rowth	
			ntrolling plant growth a	-		-		and g	, , , , , , , ,	
C	01		an understanding of the				mbra	ane tr	ansport	, water
		_	eral uptake in plants, en						_	
		ecological interacti		J		•			_	
C	O2	Students will deve	lop a deep understandir	ng of n	itrogen	fixatio	n, n	itroge	n metal	oolism,
		and photosynthesis in plants, and their ecological importance in nutrient cycling and								
		plant growth.								
C	O3	Students will learn the physiological processes of flowering, photoperiodism, floral								
		induction, and fruit development, applying this knowledge to plant reproduction and								
		ecosystem stability.								
C	04	Students will acquire knowledge of plant responses to a biotic stresses, oxidative								
		stress, and plant toxins, enabling them to understand plant survival strategies under								
- C	0.	environmental stress.								
C	05	Students will understand the role and mechanisms of plant growth regulators and growth retardants, with practical applications in controlling plant growth and								
		development in agriculture.								
Unit-	Conten	, ,	ilcultule.	СН	Loor	ning O	utoo	mo		KL
No.	Conten	ι		CII	Leari	ing O	utco	ine		KL
I	Membr	ane transport a	nd water relations:	10	Know	ledge	of 1	necha	nisms	
		•	oteins, water potential			membr			nsport,	
			uptake and transport,			potent			•	1,2,
	_		and iron transporter in			e in pla				3
plant, l		ight and microbes	tht and microbes induced signalling in							
<u></u>	guard cell, regulation of water supply									<u> </u>
II	Nitrogen and molecular aspects of metabolism: 8 Deep understar			_						
	_	_	fixation, products of		_	en fix	atio	n, ni	_	
	_		transport, mechanism			olism,			and	1,2,
		-	ogical and molecular		photo	synthes	sis in	plant	S	3
			NO metabolism in							
			lism in relation to							
	respirati	ion.								

***	The distriction of the state of	1.0	I	
III	The flowering process: Photoperiodism and its	10	To know about the	
	significance, endogenous clock and its regulation,		physiological processes of	
	floral induction, role of vernalization. Fruit		flowering of plants.	
	development and ripening: Stages of fruit			1,2,
	development and their regulation, biochemical			3
	and related events during fruit ripening in			
	climacteric and non-climacteric fruits. Physiology			
	and biochemistry of fruit abscission, production			
	of transgenic fruits.	1.0		
IV	Stress physiology and plant toxin: Plant	10	To acquire knowledge of	
	responses to a biotic stresses, mechanisms of a		plant responses to a biotic	
	biotic stress tolerance, water deficit and drought		stresses, oxidative stress,	
	tolerance, salinity stress, metal toxicity and		and plant toxins.	
	freezing.			1,2,
	Plant responses to metal ion stress, freezing and			3
	heat stress. Effect of elevated CO ₂ concentration			
	on plant metabolism. Oxidative stress, my			
	cotoxins, protein toxins in plants. Nitrosative and			
	oxidative stress - causes and effects.			
V	Plant growth regulators: A brief idea about	7	Able to understand the role	
	discovers, role and possible mechanism of action		and mechanisms of plant	1,2,
	of Triacontanol, Brassins, Salicylic acid. A brief		growth regulators and	3
	idea about role of plant growth retardants-CCC,		growth retardants.	
	Maleic hydrazide, Trizoles and TIBA.			
Practi	1. Determination of lipid from oil seeds.	3	Students will be able to	1,2,
cal			estimate the lipid content in	3,4
			oilseeds.	٥,١
	2. Estimation of photosynthetic pigments by	3	Practical skills in measuring	
	spectrophotometric and chromatographic		and analyzing chlorophyll	1,2,
	techniques.		and carotenoid content in	3,4
			plant tissues.	
	3. To estimate the percentage of soluble protein	3	Students will learn to	1,2,
	of fresh moong, bean seedling by Lowry's		estimate protein content in	3,4
	Method and biuret reagent		plant seedlings	٥,١
	4. Estimation of oxalic acid from leaf tissue.	3	Ability to measure oxalic	1,2,
			acid levels in plants.	3,4
	5. Estimation of starch, ascorbic acid,	3	Students will learn to extract	1,2,
	polyphenols, cellulose.		and estimate starch,	3,4
			Cellulose from plants	J, <del>T</del>
	6. Extraction of plant phenols and estimation of	3	Students will learn to extract	1,2,
	total phenols.		and estimate phenolic	3,4
			compounds from plants	_ ∍, <b>+</b>
	7. Study of seed germination under stress	3	practical experience in	
	condition		studying the effects of	1,2,
			environmental stress on seed	3,4
			germination,	
	8. Study of effect of fungal infection on	3	Understand the role of	
	peroxidase activity.		peroxidase enzymes in plant	1,2,
			defence mechanisms against	3,4
			fungal infections.	
	9. Estimation of total free amino acids from plant	3	To quantify free amino acids	1,2,
ļ	1		· · · · · · · · · · · · · · · · · · ·	<u> </u>

materials through spectrophotometer. in plant tissues.				
10.To measure the activity of amylase in	3	Students will acquire		
germinating barley and moong seeds and to		practical knowledge of	1,2,	
study the effect of: (i) substrate concentration,		enzyme activity	3,4	
(ii) pH.				

#### **Text Books**

- T1. Buchanan B.B., Gruissem W and Jones R.L.(2007): Biochemistry and Molecular Biology of plants. 1st Edition IK International.
- T2. Salisburry, F.B. and Ross C.W.(1992): Plant physiology (Fourth Edition). Wadsworth Publishing Company, California, U.S.A.
- T3. Dennis D. T., Turpin, D. H. Lefebvre D. D. and Layzell D. B.(eds) (1997). Plant Metabolism (Second Edition) Longman, Essex, England.
- T4. Willium G Hopkins, Norman P Hunar (2009) Introduction to Plant Physiology, Wiley.
- T5. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition

#### Reference Books

- R1. Buchanan B.B, Gruissem W. and Jones R. L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
- R2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
- R3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

## **Other Learning Resources:**

https://www.esalq.usp.br/lepse/imgs/conteudo/Plant-Physiology-by-Vince-Ordog.pdf https://onlinelibrary.wiley.com/journal/1365313x

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students will gain an understanding of the mechanisms of membrane transport, water potential, and mineral uptake in plants, enabling them to analyze water regulation and ecological interactions in plant cells	1, 2, 3, 6				
2	Students will develop a deep understanding of nitrogen fixation, nitrogen metabolism, and photosynthesis in plants, and their ecological importance in nutrient cycling and plant growth	1, 2, 3, 6				
3	Students will learn the physiological processes of flowering, photoperiodism, floral induction, and fruit development, applying this knowledge to plant reproduction and ecosystem stability.	1, 3, 6, 7				
4	Students will acquire knowledge of plant responses to a biotic stresses, oxidative stress, and plant toxins, enabling them to understand plant survival strategies under environmental stress	1, 3, 6, 7				
5	Students will understand the role and mechanisms of plant growth regulators and growth retardants, with practical applications in controlling plant growth and development in agriculture.	1, 3, 6, 7				

SEMESTER – IV									
Course	Title		Plant Physiology	and Bi	ochemistr	y-II			
Course	code	24MSBO223R	<b>Total credits: 2</b>	L	T P	S	R	O/F	C
			Total hours: 30T	2	0 0	0	0	0	2
Pre-req		Nil	Co-requisite			Nil			
Progra		***	Master of Sci		•				
Semes			inter/II semester of Fi						
Cour			the key biochemical pat	•		•	•	ion.	
Object	iives	_	mechanisms of photoch carbohydrate and organi		_		is.		
			ne kinetics and nitrogen			11.			
			nt signal transduction pa			stand var	ious nl	lant	
		signalling mech	-	uiwaya	to unders	runa var	rous pr	iuiii	
CO	1		an in-depth understand	ing of	the bioche	mical pr	ocesse	s invo	lved in
	_	plant respiration.		8		F-			
CO	2	•	quire a comprehensiv	e und	lerstanding	of th	e me	chanis	ms of
		photosynthesis			-2			_	
CO	3	r •	the regulation of carbol	nydrate	metabolis	m and si	ıcrose	biosyı	nthesis,
		cellulose synthesis	and metabolic roles of	organio	e acids.			-	
CO	4	Students will devel	op an understanding of	enzym	e kinetics,	includin	g the o	calcula	ation of
		Km values.							
CO	5	Students will gain knowledge of plant signal transduction mechanisms, including							cluding
			signaling, phospholipid	signal					
Unit-		Conte	ent	СН	Lear	ning Ou	itcome		KL
No.				1.0	~ .				
I		-	netabolism: Overview	10	Students				
	_	_	espiration, electron transport and ATP molecular processes					of	
		esis, glycolysis in plants and its regulation, ation of pentose phosphate pathway and plant respiration.							1,2,3
	_		respiration, glyoxylate						
	1	synthesis of membra							
II		•	notosynthesis:, Photo-	8	Students	will	learn	the	
***			anism of electron and		mechanis		icarii	of	
			ion of PCR cycle and		photosyn		inclu		1.0.0
	1 -		and PEP Case, C3-C4			oto-oxid		of	1,2,3
	interm	nediates, ecologic	al significance and		water, el	lectron a	and pr	oton	
	modif	ication of CAM.			transport	•			
III	Carbo	ohydrate and orga	nic acid metabolism:	10	Students	will und	erstand	d the	
	_		sucrose biosynthesis,		regulation			and	
	I .		n of cellulose, a brief		sucrose b	oiosynthe	esis		1,2,3
			thesis and enzymes						-,-,-
		-	lation, metabolism and						
13.7		· · · · · · · · · · · · · · · · · · ·	bic acid and malic acid	10	C4-1-1	•1	1	1	
IV	-	<b>ne kinetics</b> : Km va. s responsible for en:	lue, enzyme inhibition,	10	Students	wil ge of		gain	
		-	ganization, function		knowledg	ge or inclu		the	
	-	gulation of nif and	-		determin		of	Km	
		criptional and post t	~		values.	ut1U11	01	12111	1,2,3
		tion of nitrate assim	•		, aracs.				
	_	cular aspects of seed	•						
	dorma	-	<i>C</i>						
		J		L	L				

V	Signal transduction: Receptors and G-proteins,	7	Students will gain		
	phospholipids signalling, calcium- bcalmodulin		knowledge of plant signal		
	cascade. Specific signalling mechanisms, two		transduction mechanisms,		
	component sensing/signalling system in plants.		including receptor-G-		
	Secondary metabolites: Shikimate pathway and		protein.		
	its role in biosynthesis of secondary metabolites,	netabolites,			
	biosynthesis of terpens, phenols and nitrogenous				
	compounds.				

#### **Text Books**

- T1. Buchanan B.B., Gruissem W and Jones R.L.(2007): Biochemistry and Molecular Biology of plants. 1st Edition IK International.
- T2. Salisburry, F.B. and Ross C.W.(1992): Plant physiology (Fourth Edition). Wadsworth Publishing Company, California, U.S.A.
- T3. Dennis D. T., Turpin, D. H. Lefebvre D. D. and Layzell D. B.(eds) (1997). Plant Metabolism (Second Edition) Longman, Essex, England.
- T4. Willium G Hopkins, Norman P Hunar (2009) Introduction to Plant Physiology, Wiley.
- T5. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition

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- R1. Buchanan B.B, Gruissem W. and Jones R. L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
- R2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
- R3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi

#### **Other Learning Resources:**

https://www.sciencedirect.com/journal/journal-of-plant-physiology https://link.springer.com/journal/40502

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students will gain an in-depth understanding of the biochemical processes involved in plant respiration.	1, 3, 6				
2	Students will acquire a comprehensive understanding of the mechanisms of photosynthesis.	1, 2, 3, 6				
3	Students will learn the regulation of carbohydrate metabolism and sucrose biosynthesis, cellulose synthesis and metabolic roles of organic acids.	1, 3, 6				
4	Students will develop an understanding of enzyme kinetics, including the calculation of Km values.	1, 2, 3, 6, 7				
5	Students will gain knowledge of plant signal transduction mechanisms, including receptor-G-protein signaling, phospholipid signaling,	1, 3				



# **Assam down town University**

# Curriculum and Syllabus

# **Master of Science in Chemistry**

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM Version: 1.0

FACULTY OF SCIENCE

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the programme

and to be eligible for the degree. This volume also includes the prescribed literature, study

materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

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Chairperson, Board of Studies

Member Secretary, Academic Council

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# Vision

To become a Globally Recognized University from North Eastern Region of India, dedicated to the Holistic Development of Students and Making Society Better

# Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

# **Programme Overview**

Master of Science (M.Sc.) in Chemistry is a two-year-long postgraduate degree programme in the field of science and it is divided into four semesters. M.Sc. in Chemistry provides an understanding of the variety of physical and biological phenomena with the knowledge of natural and chemical processes. The chemistry course at the postgraduate degree programme is specially designed for students willing to pursue a career in industry, academia, and research. The course provides in-depth knowledge in the fields of Inorganic Chemistry, Organic Chemistry, Medicinal Chemistry, Physical Chemistry, and Analytical Chemistry. Through research-driven approach the candidates will get practical knowledge to solve complex problems in various fields, such as pharmaceuticals, petrochemicals and other research-based industries. It will give a wide range of scope and career opportunities for students in science-related fields both in private as well as government companies.

# I. Specific Features of the Curriculum

The Master of Chemistry curriculum features core courses in inorganic chemistry, organic chemistry, and physical chemistry, with electives in organic synthesis, natural products, organometallic chemistry and catalysis, Inorganic Reaction Mechanism and Kinetics. It emphasizes hands-on laboratory skills, and includes a substantial research thesis project along with seminars, workshops, or industrial internships. The program incorporates interdisciplinary approaches, regulatory and ethical training, and develops essential soft skills such as scientific communication and project management. Additionally, it offers global perspectives on issues related to chemistry and environment, preparing graduates for diverse careers in research, industry, and academia.

The curriculum provides skill enhancement and value-added courses along with the core papers.

# II. Eligibility Criteria:

Graduation with Chemistry as honours subject along with any two of the following as subsidiary subjects: i) Physics, ii) Mathematics iii) Biotechnology iv) Zoology v) Botany with minimum of 45% marks in aggregate or equivalent grades (CGPA) (5% relaxation for reserved categories) from any recognized University/Institution

## **III.** Program Educational Objectives (PEOs):

- **PEO-1:** AdtU Chemistry Postgraduates will be well prepared for successful careers in industry and/or in government in one or more following areas: petrochemicals, pharmaceuticals, polymers, paints, research and forensic laboratories, etc.
- **PEO-2:** AdtU Chemistry Postgraduates will be academically prepared to contribute effectively to the growth and development of applied chemical sciences and allied domains.
- **PEO-3:** AdtU Postgraduates will be successful in higher education in related areas of energy, pharmaceuticals, material science, polymer technology, chemical engineering if pursued.

# **IV.** Program Specific Outcomes (PSOs):

- **PSO1:** Interdisciplinary Knowledge: Exhibit an in-depth understanding of the concept of chemical sciences and apply interdisciplinary knowledge and proficiency to address the challenges within the domains of chemistry and relevant fields.
- **PSO2: Innovation and Entrepreneurship:** Apply multidisciplinary approach for research exploration and collaboration with professionals across diverse disciplines contributing to innovation and entrepreneurship
- **PSO3:** Global certification: Exhibit global competency to excel in the profession.

# V. Program Outcome:

- **PO1: Disciplinary knowledge**: Apply fundamental knowledge of chemical sciences in practice.
- **PO2**: **Problem Solving:** Identify, assess, plan, design and carry out scientific experiments accurately and analyze the results to resolve problems
- **PO3:** Communication: Communicate effectively with peers, community and society at large to exchange clear instructions.
- **PO4**: **Professional Ethics and Values**: Comply with ethical principles in the profession and act in accordance with human values.
- **PO5:** Research-In-Practice: Identify, apply and analyze the complex scientific problems using advanced research methodology in chemistry and design a meaningful solution.
- **PO6:** Modern Tool Usage: Apply appropriate resources, modern scientific tools and techniques to resolve scientific problems with a proper explanation.
- **PO7: Environment and Sustainability**: Apply principles of chemistry for addressing social, economic, environmental problems, and towards achieving sustainable ecosystem.
- **PO8:** Lifelong Learning: Engage in independent and lifelong learning staying abreast with the advancements in technology and practices related to chemistry.

#### VI. Total Credits to be Earned: 89

## VII. Career Prospects:

Upon completing the program, graduates can pursue a wide range of careers across industries, academia, and government as well as private sectors. They are well prepared for industrial and research work in fields such as Pharmaceuticals & Biotechnology, Chemical Manufacturing, Food & Beverage Industry, Cosmetics & Personal Care, Petroleum & Energy. They can also opt for academic positions as teachers and research assistant. The graduates can pursue career in interdisciplinary fields like Forensic Science, Environmental Science, Regulatory Affairs and other Emerging Fields such as Nanotechnology & Materials Science, Data Science & Computational Chemistry, Intellectual Property & Patent Law. Moreover, graduates can go for a Ph.D. in Chemistry and for advanced research positions or specialized careers.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

## A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

# **INSTRUCTION**

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

# **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

# Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

# **III. Pattern of Question Papers**:

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level Questions /verbs for test		
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when,	
1	Kemember	where, etc.	
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.	
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify	
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.	
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.	
6	Create Design, Formulate, Modify, Develop, integrate, etc.		

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Sl noQuestion patternTotal marks1MCQs (10 Questions)1022 Marks questions (10 Questions)2034 Marks questions (5 Questions)20410 Marks questions (1 Question)10

Table 1: Question paper pattern for End semester examination

# IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

# V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new

answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

# VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

# **VIII. Provision for an Amanuensis (writer):**

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

## C. Credit Point:

It is the product of grade point and number of credits for a course, thus, CP = GP x CR

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

## ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade **Grade Points Description** 10 Outstanding  $\mathbf{O}$ 9 Excellent A+8 Very Good A B+ 7 Good В 6 Above Average  $\mathbf{C}$ 5 Average P 4 Pass F 0 Fail Abs 0 Absent **UFM** 0 **Unfair Means** 

**Table 2: Letter Grades and Grade Points** 

# iv. Grade Point Average:

# a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the

Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

# b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words,taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight)of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

## **D.** Post-Examination

## i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

# ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

# INSTRUCTION TO TEACHERS AND STUDENTS

# (Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favour because this strategy for teaching is seen to favor passive students.

# 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watchvideo or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned problem. The same has to be done in group so that the students discuss among

themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

# The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of	
teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

# Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file

# **Breakdown of Credits**

Sl. No.	Category	Total number of
		Credits
1.	Discipline Specific Core (Major)	19
2.	Discipline Specific Core (Minor)	8
3.	Skill Enhancement Course (SEC)	4
4.	Discipline Specific Elective (DSE)	18
5.	Ability Enhancement Course (AEC)	6
6.	Value Added Course (VAC)	4
7.	Co and extra-Curricular	2
8.	Multidisciplinary Course (MDC)	2
9.	Field Training	2
10.	Research /Industry Internship	20
11.	Summer Internship	4

# **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	83	93.26%
2	Humanities and Social Sciences	6	6.74%
	Total	89	100%

# SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course		Er	ıgag	eme	ent			Max	imum M	Iarks	
				Category	L	T	P	S	R	0	С	IA*	SEE*	PE*	Total
	1	24MSCH1101R	Inorganic Chemistry-I	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSCH1102R	Organic Chemistry-I	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Semester I	3	24MSCH1103R	Physical Chemistry-I	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Seme	4	24UMFS1101R	Fundamental of Statistics	MDC	1	0	2	0	0	0	2	40	60	100	200
	5	24UMPD1101R	Effective Communication (PDP)	AEC	0	0	4	0	0	0	2	50	0	50	100
	6	24UMEC1101	Extra-curricular	Co and extra- Curricular	0	0	0	0	0	0	1	0	0	100	100
		Total									17				1000
	S. No.	Course Code	Course Title	Course Category	L	Er	ngag P	eme	ent R	О	С	Max IA*	imum M for SEE*	Iarks PE*	Total
	1	24MSCH1201R	Inorganic Chemistry-II	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSCH1202R	Organic Chemistry-II	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSCH1203R	Physical Chemistry-II	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	4	24UMPD1201R	Advanced Communication	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester II	5	24MSCH1204R	Postgraduate Practice Teaching	SEC	1	0	0	0	0	0	1	0	0	100	100
Se	6	24MSCH1205R	Research Methodology and Statistical Analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using MS Excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSCH1206R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100
	9	24UMCC1201	Co-curricular	Co and extra Curricular	0	0	0	0	0	0	1	0	0	100	100
		Total									22				1300

	S.	Course Code	Course Title	Course		E	ngag	geme	ent			Max	imum N for	1arks	
	N.			Category	L	Т	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSCH2101R	Symmetry and Group Theory	DSC Major	3	0	0	0	0	0	3	40	60	0	100
	2	24UMPD2101R	(PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	3	24MSCH2102R	Internship	Internship	0	0	0	0	0	32	4	0	0	100	100
	4	24MSCH2103R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100
Ш	5	24MSCH2104R	Research Project- I	Research/ Industry Internship	0	0	8	0	0	0	4	0	0	100	100
Semester III	6	24MSCH2105R	Indian knowledge system	VAC	0	0	0	0	0	0	2	0	0	100	100
			Discipline speci	fic Elective (	Any	thr	ee sı	ıbje	cts t	o be	selec	ted)			•
	7	24MSCH2106R	Biochemistry	DSE	3	0	2	0	0	0	4	40	60	100	200
	8	24MSCH2107R	Spectroscopy	DSE	4	0	0	0	0	0	4	40	60	0	100
	9	24MSCH2108R	Environmental and Green Chemistry	DSE	3	0	2	0	0	0	4	40	60	100	200
	10	24MSCH2109R	Chemistry of Catalysis	DSE	4	0	0	0	0	0	4	40	60	0	100
	11	24MSCH2110R	Food Chemistry	DSE	3	0	2	0	0	0	4	40	60	100	200
		Total								28				1000- 1200	
	S. No.	Course Code	Course Title	Course Category			ngag						imum N for		
	110.				L	Т	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	24MSCH2201R	Research Project-II	Research/ Industry Internship	0	0	32	0	0	0	16	0	0	100	100
			Discipline spec	ific Elective	(An	y tw	o su	bjec	ets to	be s	select	ted)			
r IV	2	24MSCH2202R	Advanced Organic Synthesis	DSE	3	0	0	0	0	0	3	40	60	0	100
Semester IV	3	24MSCH2203R	Natural Products Chemistry	DSE	3	0	0	0	0	0	3	40	60	0	100
	4	24MSCH2204R	Organometallic Chemistry and Catalysis	DSE	3	0	0	0	0	0	3	40	60	0	100
	5	24MSCH2205R	Inorganic Reaction Mechanism and Kinetics	DSE	3	0	0	0	0	0	3	40	60	0	100
		Total									22				300
		Grand To	otal		_						89				

(Note: In third semester five and in fourth semester four elective courses are offered. Students may choose three courses in the third semester and two courses in the fourth semester. Although the total credit due to this selection will remain unchanged, the total marks may vary due to the combination of these courses.)

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEMESTER- I									
Course Ti	itle		Inorganic Chemis	try-I								
Course Co	ode	24MSCH1101R	Total credits: 4	L	T	P	S	R	O/F	C		
			Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requi	site	Nil	Co-requisite					Nil				
Anti-requi	isite	Nil		•								
Program	me	Master of Science in Chemistry										
Semeste	er	Fall/I Semester of First Year of the Program										
Course		1. To study the chemical bonding of different homo and hetero nuclear molecules.										
Objectiv			of different borane and polyh				_					
		_	king structures of different i		solid	com	pou	nds.	•			
			4. To study the concept of different acid base theories.									
		·	different redox reactions, cor									
CO1			and different bonding theo	ories a	issoc	iated	l wi	th v	arious	s types of		
		molecules.										
CO2		· ·	d bonding of borane and oth		•							
CO3			ifferent packing spheres asso		d wit	h ior	nic s	olic	ls.			
CO4			oncepts of acid base theories									
CO5			oxidation and reduction i	reactio	ons	along	g w	ıth.	know	ledge on		
TT */ NT		corrosion and its preven			,	1	T	•		171		
Unit-No.		Con	tent	Con		1	Lea		_	KL		
T	Ch	omical bandina		t He	our		Out			1.2		
I	1	emical bonding bes of bonding, Valence	hand theemy VCEDD	10		1		_	ge on ot of	1, 2		
			ry, LCAO-MO methods in			1	fere	•	01 01			
		no and heteronuclear dia				emio						
		,NO).MO description of				nds						
		lecules (CO ₂ , NO ₂ , NO ₂				iius Tere						
	1	ybridization and its appli						eories				
	/;,	,					ng v					
							amp					
						1	•		and			
						het	tero	nuc	elear			
						mo	leci	ıles				
II	Ino	organic Chains, rings, c	ages and clusters	10	0	Un	der	stan	d the	1,2		
	Cat	enation, Heterocatenation	on, Zeolites, Intercalation,			fur	ndan	nen	tal			
	Str	ucture and bonding in	borazine, phosphazenes,			kno	owle	edge	eof			
	pol	yhedral boranes, carbor	ranes, metalloboranes and			dif	fere	nt ri	ng,			
	1	· · · · · · · · · · · · · · · · · · ·	notation, Wade's rules,			cag	ge lil	ke				
	1 -		ant in polyhedral boranes,			1			along			
	Ino	rganic clathrates.					th di					
						1 ^	lyhe					
							uctu		of			
							rane	_				
	C -								anes.	1.2		
III		id state Chemistry:	1 1 1 1	10	U			_	e on	1,2		
			xagonal and cubic close						ionic			
	_	-	octahedral holes in close-				ids		along			
	_		and alloys, solid solutions.			wit		t	their			
	Ihe	e ionic model for the	description of bonding in			dıf	fere	nt				

	•			
	ionic solids. Characteristic structures of ionic solids-		packing	
	the NaCl and CsCl types, the sphalerite and wurtzite		arrangements.	
	types of ZnS, NiAs structure type, perovskite and			
	spinel structure types of mixed-metal oxides.			
	Importance ionic radii and radius ratios in			
	determining structure type among ionic solids. Lattice			
	energy considerations, Thermal stability and			
	solubility of inorganic solids. Bonding in solids –free-			
	electron and band theory of solids, metallic bonding.			
IV	Acid, Base and Redox Chemistry: Acid-Base	7	Understand the	1, 2, 3
	concepts, Measure of Acid-Base Strengths, Acid-Base		different acid	
	in water. Non- aqueous solvent, aprotic solvent and		base concepts	
	superacids. Hard and Soft Acids and Bases,		along with the	
	Application of HSAB principle.		different	
			applications of	
			HSAB	
			principle.	
V	Oxidation and Reduction: Half cell reaction,	8	Understand	1,2, 3,
,	reduction potential, application of reduction potential		and analyse the	4
	data, electrochemical series; brief idea of corrosion		concept of	
	and its prevention; Nernst equation. Latimer and Frost		oxidation,	
	diagram, redox reactions of metal complexes in		reduction,	
	excited states, excited electron transfer, role of spin		electrochemica	
	orbit coupling, lifetimes of excited states in these		l series.	
	complexes.			
Practica	Preparation and characterization of the following	30	Students will	1,2,3,
l	complexes:		gain	4
	1.Potassium chromioxalate, K ₃ [Cr(C ₂ O ₄ ) ₃ ]		knowledge and	
	2. Reinecke's salt.		also be able to	
	3.Chloropentaminecobalt(III)chloride[Co(NH ₃ ) ₅ Cl]Cl		demonstrate	
	2		their	
	4.		experimenting	
	Nitropentaminecobalt(III)chloride[Co(NO ₂ )(NH ₃ ) ₅ ]Cl		skills in	
			synthesizing	
	5.TetraamineCu(II)sulphate [Cu(NH ₃ ) ₄ ]SO ₄ .H ₂ O		and	
	6. HexammineNi(II)chloride [Ni(NH ₃ ) ₆ ]Cl ₂		characterizing	
	. , , , , , , , , , , , , , , , , , , ,		different	
			inorganic	
			compounds.	
			1	

# **TEXTBOOKS:**

T1: J. E. Huheey, E. A. Keiter and R. L. Keiter; Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed. Pearson Education, 2006.

#### **REFERENCE BOOKS:**

**R1**: P.W. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong; Shriver & Atkins, Inorganic Chemistry, 5th Ed. Oxford University Press, 2010.

**R2**: G. L. Miessler, D Tarr; Inorganic Chemistry. 3rd Ed., Pearson Education, 2004.

R3: J. D. Lee, Concise Inorganic Chemistry, 5th Ed. Blackwell Science.

**R4**: J .Mendham, R .C .Denney, J.D Barnes, M. Thomas. Vogel's Textbook of Quantitative Chemical Analysis. 6th edition.

# OTHER LEARNING RESOURCES:

https://nptel.ac.in

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Define chemical bonds and different bonding theories associated with various types of molecules.	1, 2, 5, 6
2	Identify the structure and bonding of borane and other polyhedral boranes.	1, 5, 6
3	Describe the basics of different packing spheres associated with ionic solids.	1, 5, 6
4	Analyze and apply the concepts of acid base theories.	1, 5, 6
5	Identify the different oxidation and reduction reactions along with knowledge on corrosion and its prevention.	1, 5, 6

		SEMESTER- I									
Course T	tle	Inorganic Chemis	try-I								
Course Co	ode 24MSCH1102R Total	credits: 4	LT	P	S	R	O/F	C			
	Total	hours: 45T+30P	3 0	2	0	0	0	4			
Pre-requi	site Nil Co-re	quisite				Nil					
Program	ne	Master of Science in Cl	nemistr	·y							
Semeste	r Fall/I	Fall/I Semester of First Year of the Program									
Course	1. To make students recall the stereochemistry and the different modes of representation of										
Objectiv	organic compounds along with the concepts of stereogenic center.										
	2. To revise the reaction me	8									
		call about the structure &	reactiv	ity of r	eactio	on into	ermedia	tes of			
	organic chemistry.										
CO1		Explore the different modes of representation of organic compounds, their interconversion, and explain the concept of isomerism and chirality in organic compounds.									
CO2	1	• •									
CO2	Explain the concepts of stereoger				sm						
CO3	Describe the reaction mechanism					11.4	1'1_	1			
CO4	Analyse and describe the structu	ire & reactivity of reactiv	e orgai	nic inte	rmed	nates	like car	bocations			
CO5	carbanions, ylides.  Analyse and describe the struct	ura le ranativity of man	tive or	ranic :	ntamo	nedia+	es liles	carbanas			
003	nitrenes, free radicals.	uic & icactivity of feac	uve of	same 1	IIICIII	ıcuial	CS IIKC	carbelles,			
Unit-	Content		Co	ntact	1	Lear	ninσ	KL			
No.	Content			our	1	Outc	_				
I 110.	Stereochemistry I:		- 11	6			edge of	1,2			
1	Isomerism and Chirality in	Organic compounds		U		iffer	_	1,2			
	conformational analysis of sim	c		1	nodes						
	molecules, cyclohexane and dec	I		1		entati					
	Newman, Fischer and Sawhon	I		1	-	organic					
	nomenclature, concept of absolute a	3,		c	ompo	unds					
	optical purity and optical activity in			a	nd the	eir					
					1		nversio				
					1		cept of				
					1	somer					
					1		irality				
					1	n orga ompo					
II	Stereochemistry II:			4			rn the	1,2			
11	Concepts of stereogenic center –	chirotopic and achirotopi	c	7	1	oncep		1,2			
	center, homotopic and heteroto					tereog					
	(prostereoisomerism and prochiral	• •	I		1	enter,					
	enantiomeric excess.				to	picit	y and				
					p	roster	eoisom				
					e	rism.					
Ш	Reaction Mechanisms:	1 199 3 35		13			lerstand	1,2			
	Substitution reactions, Aliphatic SN1, SN2, mixed SN1 and SN2	-				ne rea	ction nisms				
	substitution, Arenium ion, SE1, S						nisms itered in				
	aromatic nucleophilic substitution					rganio					
	SRN1mechanism, Reactivity, effe					hemis					
	group and attacking species.	,					<i>J</i> -				
	Addition reactions, mechanism and	Stereochemical aspects of	$\mathbf{f}$								
	addition reactions in C-C multip										
	orientation and reactivity.										
	Elimination reactions, E1, E2 ar	d E1cB, orientation and	d								
	reactivity.										

IV	Reaction Intermediates: Structure & Reactivity I:	12	To know	1,2
	Carbocations: structure and stability of carbocations, classical		about the	
	and non-classical carbocations, neighbouring group		reaction	
	participation and rearrangements including Wagner-		intermediat	
	Meerwein, pinacol-pinacolone, semi-pinacol rearrangement,		es, their	
	C-C bond formation involving carbocations, oxymercuration,		classificatio	
	halo-lactonisation, Tishchenko reaction, Ritter reaction, Prins		ns, structure	
	reaction.		and	
			reactivity.	
	Carbanions: enolates and enamines, Kinetic and			
	thermodynamic enolates, lithium and boron enolates in aldol			
	and Michael reactions, alkylation and acylation of enolates,			
	name reactions under carbanion chemistry- Claisen,			
	Dieckmann, Knoevenegal, Stobbe, Darzen, Acyloin			
	condensations, Shapiro reaction, Julia olefination, Brook			
	rearrangement, Sakurai reaction, Henry			
	reaction,Kulinkovichreaction,Nefreaction,Baylis-Hillman			
	reaction.			
	Ylids: Chemistry of phosphorous and sulfur ylids- Wittig and			
	related reactions, Peterson olefination.	10	T. 1	1.0
V	Reaction Intermediates: Structure & Reactivity II:	10	To know	1,2
	Carbenes and Nitrenes: Structure of carbenes, generation of		about the	
	carbenes, addition and insertion reactions, rearrangement		reaction	
	reactions of carbenes such as Wolff rearrangement and Arndt-		intermediates,	
	Eistert synthesis, generation and reactions of ylids by		their	
	carbenoid decomposition (existence of O and N based ylids),		classifications	
	Structure of nitrene, generation and reactions of nitrene and		, structure and	
	related electron deficient nitrogen intermediates, Curtius,		reactivity.	
	Hoffmann, Schmidt, Lossen, Beckmann rearrangement, Tebbeolefination reactions.			
	Radicals: Generation of radical intermediates and its (a)			
	addition to alkenes, alkynes (inter &intramolecular) for C-C			
	bond formation and Baldwin's rules (b) fragmentation and			
	rearrangements. Name reactions involving radical			
	intermediates (Barton deoxygenation and decarboxylation,			
	McMurry coupling).			

## **TEXTBOOKS**:

T1: Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications. Revised 2nd edition. New Age International Publishers; 2007.

T2: Bruice, P. Y. Organic Chemistry. 8th edition. Pearson; 2020.

T3: March, J. Advanced Organic Chemistry: Reactions, Mechanisms, and Structure. 4th edition. Wiley; 2016.

# **REFERENCE BOOKS:**

R1: Clayden, J., Greeves, N. and Warren, S. Organic Chemistry. 2nd edition. Oxford University Press; 2012.

R2: Vogel, A.I. Textbook of Practical Organic Chemistry. 5th edition Prentice Hall.

#### OTHER LEARNING RESOURCES:

https://nptel.ac.in

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
	Explore the different modes of representation of organic compounds, their	
1	interconversion, and explain the concept of isomerism and chirality in	1, 5, 6
	organic compounds.	
2	Explain the concepts of stereogenic center, topicity and prostereoisomerism	1, 5, 6
3	Describe the reaction mechanisms encountered in organic chemistry.	1, 5, 6
4	Analyse and describe the structure & reactivity of reactive organic	1.5.6
4	intermediates like carbocations, carbanions, ylides.	1, 5, 6
5	Analyse and describe the structure & reactivity of reactive organic	1.5.6
3	intermediates like carbenes, nitrenes, free radicals.	1, 5, 6

SEMESTER – I												
Course		447.50.07714.047	Physical Chemi	stry-I			_	I ~		0.75		
Course	code	24MSCH1103R	Total credits: 4		L	T	P	S	R	O/F	C	
-	• • •	270	Total hours: 45T+30P		3	0	2	0	0	0	4	
Pre-requ		Nil	Co-requisite		~ .			N	il			
Progran			Master of Sc									
Semest			Fall/ I semester of fi									
Cours			1. To determine the sequence of elementary reactions, or the reaction mechanism, that comprise									
Objecti		complex reactions										
		_	ledge on equilibrium ther	-		_		_		1 70	.,	
		3. To study the basics of quantum mechanics, particle in a box, its degeneracy and Jahn Teller distortion.										
G01			Explore the integrated rate laws to find the value of one variable, given values of the other									
CO1		_	ited rate laws to find the	value	of one	varıa	ble, g	given	values	of the	e other	
COA		variables.	1.1 (77) 1	•	1 .				1 .	.1 .	1 1	
CO2			cond Law of Thermodyna	mics and	d entrop	y co	ncepts	s in an	alysın	ig the t	hermal	
G02		efficiencies of heat			. 1	1						
CO3		_	tes of quantum mechanics	_		_						
CO4			uantization: Particle in a l					11	.•			
COS			s the concepts and proce	edures o	of samp	lıng,	data	collec	tion,	analysi	s and	
		reporting.		СН								
Unit-No.					Learn					K		
I			•	10			_	thekir	netics		1,2	
			pplications, Mechanism				nt typ					
	of photochemical (hydrogen-bromine and						and tl					
			ain (hydrogen-bromine					nders				
	react		of acetaldehyde),					nd the				
			oscillatory reactions		diffe	erent	reacti	on rate	es.			
	`	ousov-Zhabotinski	,									
		•	rates, Straight chain									
		•	gen-oxygen reaction,									
	_		y of absolute reaction									
		=	theory, thermodynamic									
			son of results with									
		ng and Arrhenius eq									_	
II	_		ynamics: Brief review	15			_	variou	IS	1,	2	
		•	nctions and laws of		_	libriu						
			erature dependence of			•		c func	tions			
		nodynamic function			and	relate	ed law	s.				
	-	-	properties: partial molar									
			al molar volume, partial									
			nd their significances.									
			etermination of partial									
			bbs-Duhem and Gibbs-									
	Duh	•	equation, excess									
		modynamic function										
		•	ulation of entropy,									
	Residual entropy.  Non-ideal system: thermodynamics of real											
	gases and gas mixtures, fugacity and its											
			l solutions, activity and									
		•	erent scales of activity									
		ficient, electronic ac										
		-	of phase equilibrium,									
		_	application to one, two									
			tems - triangular plots-									
	water-acetic acid-chloroform system.											

III	Basics of Quantum Chemistry: Planck's	8	Knowledge about various	1,2
	Quantum theory, wave particle duality,		postulates of quantum	1,2
	Uncertainty Principle, Postulates of Quantum		mechanics like Planck's	
	mechanics, operators- linear, Hermition and		Quantum theory, wave	
	angular momentum operators, eigen values and		particle duality, uncertainty	
			1 -	
	eigen functions		Principle and discuss about	
TX 7			the eigen functions.	1.0
IV	Schrodinger Equation, Free particle, particle in	6	Knowledge on the origin of	1,2
	a box, degeneracy and Jahn- Teller distortion,		quantization: Particle in a box	
	harmonic oscillator, rigid rotator, the H-atom,		degeneracy and Jahn- Teller	
	angular momentum, Spin-spin orbit coupling.		distortion, harmonic oscillator,	
			rigid rotator and Hydrogen	
			atom.	
V	Sampling and Data Analysis: Definition of	6	Knowledge onevaluation of	1,2
v	terms, Precision, deviation, mean deviation,	0	analytical data.	1,2
			anarytical data.	
	standard deviation, accuracy, absolute absolute			
	and relative errors, linear regression, covariance			
D 41 1	and correlation coefficient.	20		1 2 2 4
Practical	Chemical Kinetics (any five to be performed  mandatorily)	30	Gain knowledge, understand about chemical	1,2,3,4
	mandatorily)		kinetics and	
	a) Study the hydrolysis of methyl acetate			
	catalysed by HCl and equinormal		conductometry, apply their	
	solution of urea hydrochloride, and hence		concepts for various	
	determines the degree of hydrolysis of		determinations and analyse	
	the salt.		their studies.	
	b) Determination of relative strength of two			
	acids by studying the hydrolysis of			
	methyl ester.			
	c) Study the saponification of ethyl acetate			
	by sodium hydroxide and determine the			
	order of reaction and energy of			
	activation.			
	d) Study the kinetics of the reaction between			
	iodine and acetone in acidic medium by			
	half-life period method and determine the			
	order with respect to iodine and acetone.			
	e) Study the inversion of cane sugar in			
	presence of two acids and determine the			
	relative strengths of the two acids.			
	f) Study the kinetics of the reaction between			
	hydrogen peroxide and hydrogen iodide.			
	2. Conductometry (any five to be performed			
	mandatorily)			
	a) Determine the equivalent conductivity of			
	acetic acid at infinite dilution by			
	Kohlrausch's method and determine the			
	degree of hydrolysis of the acid.			
	b) Determine the relative strength of			
	chloroacetic acid and acetic acid by			
	conductance measurements.			
	c) Determine the solubility and solubility			
	product of PbSO ₄ at room temperature by			
	conductance measurements.			
	d) Determine the composition of a mixture			
	of acetic acid and hydrochloric acid by			

	conductometric titration.		
e)	To estimate the concentration of H ₂ SO ₄ ,		
	CH ₃ COOH and CuSO ₄ by		
	conductometric titration with NaOH		
	solution.		
f)	To estimate the concentration of HCl,		
	CH ₃ COOH and CuSO ₄ by		
	conductometric titration with NaOH		
	solution.		

#### **TEXT BOOKS:**

- T1. Puri, B.R., Sharma, L.R. and Pathania, M.S. Principles of Physical Chemistry. Vishal Publishing Company; 2008.
- T2. P. W. Atkins, Molecular Quantum Mechanics, Oxford University Press, 1983.

# **REFERENCE BOOKS:**

- R1. Levine, I. R. Physical chemistry. 6th edition, Mcgraw Hill Education; 2011.
- R2.Vogel, A. I., & Jeffery, G. H. Vogel's textbook of quantitative chemical analysis. 1989.
- R3. I. N. Levine, Quantum Chemistry, Allyn and Bacon, 1983.
- R4. D. A. McQuarrie, Quantum Chemistry, University Science Books, 1983.

## **OTHER LEARNING RESOURCES:**

## https://nptel.ac.in

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explore the integrated rate laws to find the value of one variable, given values of the other variables.	1, 5, 6						
2	Apply First and Second Law of Thermodynamics and entropy concepts in analysing the thermal efficiencies of heat engines.	1, 5, 6						
3	Discuss the postulates of quantum mechanics and operator algebra.	1, 5, 6						
4	State the origin of quantization: Particle in a box and Hydrogen atom.	1, 5, 6						
5	Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.	1, 5, 6						

	SEMESTER –	[											
Course	Title	Fundamental of Statistics											
Course	code	24UMFS1101R	Total credits: 2	L	T	P	S	R	O/F	C			
			Total hours: 15T+30P	1	0	2	0	0	0	2			
Pre-req		Nil	Co-requisite	equisite Nil									
Progran			Master of Science in Chemistry										
Semes			Fall/I Semester of Fir										
Course obj	ectives		derstand the role of statistic	es in d	ata an	alysis, d	ecision	-making	, and scie	entific			
		research											
			students to descriptive st			_				-			
		i i	edian, mode) and meas	ures	OI d18	spersion	(range	e, varia	nce, sta	indard			
		deviation).  3. Teach students	anta havy ta aummaniza an	d nrag	ant da	to affaat	ivalv u	aina tahl	as about	a and			
		graphs	ents how to summarize an	u pres	CIII Ua	ia effect	ivery u	sing tabl	ies, chart	s, and			
CO	1	~ .	ing of Descriptive Statistic	s and	Demo	oranhy							
CO		•	to understand the Probabi				ion and	l samnli	ng metho	nds			
CO			e to understand the meth										
		analysis.	anaorbana me men	1	J. 11 y	- 0 1110010	5511118	, unu D	10105104				
CO		•	to understand the principle	es of v	arious	statistic	al anal	yses of c	lata.				
CO			on R language for data an										
Unit-No.	Conten		<u> </u>	CH		Learni	ng Out	come		KL			
I			efinition and scope of					Understa	nding	1,2			
			atistical population and			of Statistical Concepts							
	sample.	Data: quantitative a	and qualitative, attributes,		3	•							
	variable	es, scales of measu	rement nominal, ordinal,										
	interval	and ratio.											
II			nd graphical, including			Profici	-	in	Data	1,2			
	_	_	Measures of Central	1		Present	ation a	nd Analy	ysis				
		•	d positional. Measures of		3								
	_	• •	deviation, mean deviation,	1									
	and kur	d deviation, coefficient of variation, skewness											
III			, scatter diagram, simple,			Knowle	edae a	on A	Analyzins	1.2			
111			ation (3 variables only),			Bivaria	_	,					
		orrelation. Simple linear regression, fitting of			3		Bivariate Data and Relationships						
	1	nials and exponentia											
IV			sample point and sample			Unders	tanding	g of Pi	robability	1,2			
	1		of Events, concepts of	1		and Dis	stributio	ons					
		•	austive events. Definition										
	_	•	and relative frequency										
		_	ility space, Properties of	1	3								
	1		of events, Conditional	1									
	1 *	•	pound probability rules,	1									
	Normal	1	Distribution, Bionomial	1									
	probabi Distribi	•	Poisson Probability and its applications.										
V			ametric test: t-test, z-test,			Applica	ation	of H	ypothesi	1.2			
			metric test: One sample		_			atistical		-,-			
_			on Signed test, Mann-		3		,						
		y Test, Kruskal wali:	=										
Practical			ogramming language and			A brief	know	ledge on	using I	1,2,			
	environ	ment for data analys	is and graphics. Syntax of			for	data	analysi	is and	3,4			
	_		and assignment, vector		30	visualiz	zation						
			gular sequence, logical		50								
			dex vectors; selecting and										
	modify	ing subsets of datase	t										

2.Data objects: Basic data objects, matrices, partition			
of matrices, arrays, lists, creating and using these			
objects; Functions- Elementary functions and			
summary functions, applying functions to subsets of			
data. Data frames: The benefits of data frames,			
creating data frames, combining data frames, Adding			
new classes of variables to data frames; Data frame			
attributes.			
3.Importing data files: import. data function, read.			
table function; Exporting data: export. data function,			
cat, write, and write. table functions, function,			
formatting output - options, and format functions;			
Exporting graphs -export. graph function. Graphics in			
R: creating graphs using plot function, box plot,			
histogram, line plot, steam and leaf plot, pie chart,			
bar chart, multiple plot layout, plot titles, formatting			
plot axes; Visualizing the multivariate data: Scatter			
plot, Q-Q plot, P-plot.			
4.Performing data analysis tasks: Reading data with			
scan function, exploring data using graphical tools,			
computing descriptive statistics, one sample tests,			
two sample tests, Goodness of fit tests.			
5.Parametric test and Non-Parametric test			
	of matrices, arrays, lists, creating and using these objects; Functions- Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3.Importing data files: import. data function, read. table function; Exporting data: export. data function, cat, write, and write. table functions, function, formatting output - options, and format functions; Exporting graphs -export. graph function. Graphics in R: creating graphs using plot function, box plot, histogram, line plot, steam and leaf plot, pie chart, bar chart, multiple plot layout, plot titles, formatting plot axes; Visualizing the multivariate data: Scatter plot, Q-Q plot, P-plot.  4.Performing data analysis tasks: Reading data with scan function, exploring data using graphical tools, computing descriptive statistics, one sample tests, two sample tests, Goodness of fit tests.	of matrices, arrays, lists, creating and using these objects; Functions- Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3.Importing data files: import. data function, read. table function; Exporting data: export. data function, cat, write, and write. table functions, function, formatting output - options, and format functions; Exporting graphs -export. graph function. Graphics in R: creating graphs using plot function, box plot, histogram, line plot, steam and leaf plot, pie chart, bar chart, multiple plot layout, plot titles, formatting plot axes; Visualizing the multivariate data: Scatter plot, Q-Q plot, P-plot.  4.Performing data analysis tasks: Reading data with scan function, exploring data using graphical tools, computing descriptive statistics, one sample tests, two sample tests, Goodness of fit tests.	of matrices, arrays, lists, creating and using these objects; Functions- Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3.Importing data files: import. data function, read. table function; Exporting data: export. data function, cat, write, and write. table functions, function, formatting output - options, and format functions; Exporting graphs -export. graph function. Graphics in R: creating graphs using plot function, box plot, histogram, line plot, steam and leaf plot, pie chart, bar chart, multiple plot layout, plot titles, formatting plot axes; Visualizing the multivariate data: Scatter plot, Q-Q plot, P-plot.  4. Performing data analysis tasks: Reading data with scan function, exploring data using graphical tools, computing descriptive statistics, one sample tests, two sample tests, Goodness of fit tests.

# **Textbooks:**

T1.Methods in Biostatistics by K S Negi, ISBN:9789374735053,4th Edition, Year:2023, AITBS Publishers, INDIA **Reference books** 

R1."Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig R2. "Statistics" by David Freedman, Robert Pisani, and Roger Purves

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Improve understanding of Descriptive Statistics and Demography.	1, 4,8
2	Develop knowledge to understand the Probability theory, Distribution, and sampling methods.	1, 4, 8
3	Develop knowledge to understand the methods for hypothesis testing and Biological data analysis.	1, 4, 8
4	Develop knowledge to understand the principles of various statistical analyses of data.	1, 4, 8
5	Develop knowledge on R language for data analysis	1, 4, 8

	SEMESTER – I									
Course Title		EFFECTIVE (	COM	MUNIC	CATIO	N				
Course code	24UMPD1101R	Total credits: 2	L	T	P	S	R	O/F	C	
		Total hours: 60P	0	0	4	0	0	0	2	
Pre-requisite	Nil	Co-requisite				Nil			•	
Programmes		Master of Science in Chemistry								
Semester		Fall/I Semester of Fi					e			
Course objectives		e the types of sentences a		_						
		en the students' vocabular	-			_		_		
		ize the students with the in							itions.	
		ethe3P's (Planning, priori	_	_				_		
		ight into English pronunci			centra	l conce	pts in p	honetics.		
CO1	, ,	the different types of sen								
CO2		skills of reading and spea					ınicatio	n.		
CO3	Illustrate code Etiqu	ette sessions will boost th	eir co	nfidenc	e and n	norals.				
CO4	Describe about the	effective and efficient util	ization	of tim	e.					
CO5	Explain the concept	of Phonetics and its impo	rtance	will in	nprove	the lear	rners 'p	ronunciat	ion	
MODULES	Module 1- Gramm	ar								
	Interchange of Inte	rrogative and Assertive S	Senten	ces, Ex	clamat	ory an	d Asser	tive Sent	ences,	
	Types of Tenses, Co	ommon Errors, Synonyms	, Anto	nyms,	Homon	yms				
	Module 2- Reading									
	Techniques of Effe	ective Reading, Gathering	g idea	s and	inform	ation fi	rom a t	ext The	SQ3R	
	Technique Interpret	the text								
	Module 3-Listenin	g Skills								
	What is listening?,	The Process of Listening,	Factor	rs that a	dverse	ly affec	t Lister	ing, Diff	erence	
	_	and Hearing, Purpose a	and In	nportan	ce of	Effecti	ve List	ening, H	ow to	
	Improve Listening									
	Module 4- Conflict Management									
		Conflict Management, I	Effects	of Co	nflict N	/Ianage	ment, N	Aethods t	o deal	
	with Conflicts (Neg	· · · · · · · · · · · · · · · · · · ·								
	Module 5- Time-M	U								
		Introduction To Time Management, Purpose And Importance of Time Management, Basic Tips								
	to Maintain Time.									
		solving activity: A situati			ven to t	he stud	ents and	d they wil	l have	
	to tell us how to har	ndle the situation or solve	the pr	oblem.						

## **TEXTBOOKS:**

- T1. Wren, P.C and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
- T2. English Grammar in Use, Raymond Murphy 4th edition, CUP.
- T3. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

## **REFERENCE BOOKS:**

- R1. English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- R2. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Analyse and identify the different types of sentences.	3, 8						
2	Able to integrate the skills of reading and speaking in professional communication.	3, 8						
3	Illustrate code Etiquette sessions will boost their confidence and morals.	3, 8						
4	Describe about the effective and efficient utilization of time.	3, 8						
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	3, 8						

SEMESTER – II												
Course Ti			anic Ch	emistr	y-II				,			
Course co	ode 24MSCH1201R	Total credits: 4		Ţ	L	T	P	S	R	O/F	C	
		Total hours: 45T+30			3	0	2	0	0	0	4	
Pre-requis		Co-requisi										
Programi		Master of										
Semeste		Spring/II Semester o					_					
Course		ents understand the bor	_			-	gneti	c proj	perti	es		
Objectiv		with the transition		_				1	*.1	. 1 1		
		ents understand the diffe	rent reac	tion me	echan	usms	assoc	iated w	ith oc	tahedra	al	
		nar complexes.	diaaatir			and #	سمد مما	liaatia		a aiata d	1:415	
	radioactive iso	knowledge on different ra	adioactiv	e proce	esses	ana t	пе арр	псано	ns ass	ocialeo	ı willi	
CO1		ncept of different bonding	ag system	me occ	ociote	ad w	th d ⁿ	aveter	s of t	rongitie	<b></b>	
COI	metal complexe	_	ig syste	1115 asso	JCIan	zu wi	uiu	system	18 01 t	iansin	J11	
CO2	-	ent term symbols associa	ated with	h the di	iffere	nt d ⁿ	syste	ms and	1 their	· use in	1	
CO2	construction of the	•	ited with	ii tiic ui	illele	iii u	sysic	iiis aire	ı tilcii	usc III	ı	
CO3		etic properties of transit	tion met	al syste	ems							
CO4	_	operties shown by lantha				leme	nts.					
CO5		us radioactive processes						fradio	isoto	nes		
Unit-No.	Cont		CH				Out		15010	K	L	
I	Bonding in transition n		7			`	f d orl				2	
	Shapes of d orbitals, LI	-	·			_	nergie			-,		
	_	, d-orbital splitting in octahedral, square					h diffe					
					ysten	ns of	transit	ion				
	bipyramidal, and teti	ramidal, and tetrahedral complexes;,			metal complexes.							
	CFSE .Effects of crystal	field splitting, for d ¹										
	to d ¹⁰ systems,	pairing energy,										
	Spectrochemical series,											
	spin complexes, Jahn-Te	_										
	diagrams, magnetic prop		- 10	**		4	1:0	0 .				
II	Bonding in transition n	-	10					ferent		1,	,2	
	Term symbols and Tan Molecular orbital (MO)				n syn h d ⁿ s			ciated				
	donors). Nomenclature			WILI	nu s	ysic	1115.					
	compounds.	c of co-ordination										
III	Magnetic Properties:		10	Unc	dersta		1,2	2				
	Magnetic properties of	free ions, types of	10				aviou			1,2	_	
	magnetic behaviour: di				_		th the					
	antiferro-magnetism, ten	_						r effec	t			
	paramagnetism, magi			on t	temp	eratu	re					
	magnetic moment,	orbital contribution,			ende							
	quenching of contribution	on, effect of spin orbit										
	coupling, spin crossover. Temperatu											
dependence of magnetic susceptib												
	exchange coupling effects. Magnetic											
	properties of second and	third transition series										
** 7	and lanthanides.	1 1	10	17	1	1	1: 04	, ,		1 1		
IV	IV Lanthanides and actinide elements:					_		erent		1,2	۷	
	Electronic configuration contraction, separation o				-		own b id acti	-				
	properties of lanthanides	_			nanı nplex		iu acti	mue				
	lanthanide shift reagents			COII	прісл							
	complexes, Magnetic pro	-										
	third transition series and	-										
V	Nuclear and Radio Che		8	Kno	owled	dge o	n rad	oactiv	e	1,	,2	

	Radioactive decay processes, Fermi theory,		decay processes along with	
	half-lives, auger effect. Nuclear reactions –		the applications of	
	notations, comparison with chemical reaction:		different radioisotopes.	
	Types of nuclear reactions. Applications of			
	radioisotopes as tracers (activation and isotope			
	dilution analysis). Age determination,			
	radiolysis of water, units for measuring			
	radiation absorbed by matter, Radiation			
	induced chemistry-sources of radiation,			
	chemical effects produced by the absorption			
	of ionizing radiation and high energy ions and			
	electrons from accelerators - radiation induced			
	synthesis of materials			
Practical	1. Estimation of Mg ²⁺ and Ca ²⁺ by	30	Estimate and analyse the	1,2,3,4
	complexometric method in different ores and		different metals by	
	from given solution with one/two components.		applying the concepts of	
	2. Estimation of Zn ²⁺ and Cu ²⁺ by		different titrimetric	
	complexometric method in different ores and		analyltical techniques.	
	from given solution with one/two components.			
	3. Estimation of Fe (II) ions by titrating it with			
	K ₂ Cr ₂ O ₇ using internal indicator.			
	4. Estimation of Cu (II) ions iodometrically			
	using Na ₂ S ₂ O ₃			
	5. Estimate the amount of nickel present in a			
	given solution as bis(dimethylglyoximato)			
	nickel(II) or aluminium as oximate in a given			
	solution gravimetrically.			
	6. Determination of the composition of the			
	Fe ³⁺ -salicylic acid complex in solution by			
	Job's method.			
	7. Estimation of water of crystallization in			
	Mohr's salt by titrating with KMnO ₄ .			
	8. Estimation of oxalic acid by titrating it with			
	KMnO ₄ .			

T1. J. E. Huheey, E. A. Keiter and R. L. Keiter; Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed. Pearson Education, 2006.

T2. G. L. Miessler, D Tarr; Inorganic Chemistry. 3rd Ed., Pearson Education, 2004.

#### REFERENCE BOOKS

R1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong; Shriver & Atkins, Inorganic Chemistry, 5th ed. Oxford University Press, 2010.

R2. J.D.Lee ,Concise Inorganic Chemistry5th Ed, Blackwell Science

R3. J .Mendham, R .C .Denney, J.D Barnes, M. Thomas. Vogel's Textbook of Quantitative Chemical Analysis.6th edition.T1. Punt et al. Kuby Immunology 18th Edition. W H Freeman &Co (Sd); 2018.

## OTHER LEARNING RESOURCES:

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Summarize the concept of different bonding systems associated with d ⁿ systems of transition metal complexes.	1, 2, 3				
2	Explore the different term symbols associated with the different d ⁿ systems and their use in construction of the Orgel diagrams	1, 2, 6, 8				
3	Describe the magnetic properties of transition metal systems.	1, 2, 5, 6				
4	Distinguish the properties shown by lanthanide and actinide elements.	1, 2, 3				
5	Describe the various radioactive processes along with the applications of radio isotopes.	1, 7, 3				

			SEMESTER -	· II							
Course Ti	tle	Organic Chemistry-II									
Course co	de	24MSCH1202R	Total credits: 4		L	T	P	S	R	O/F	C
			Total hours: 45T+30P		3	0	2	0	0	0	4
Pre-requis	site	Nil	Co-requisite					Ni	l		
Programn	nes		Master of So	cience in	Che	mistry	7				
Semeste	r		Spring/II Semester of	First Ye	ar of	f the P	rogra	mme			
Course obje	ctives		n depth about metal and					ons ai	nd red	luction	s and the
		_	nployed for these reaction	_			•				
		•	photochemistry of carbony		ound	s, olefi	ins, c	onjuga	ated p	olyene	es, vision,
			l singlet oxygen photocher	-							
		=	some common and impo	rtant org	anic	name	reacti	ons al	ong w	ith the	e reagents
		used.									
			detail about pericyclic re								
CO1			nt oxidation reactions of o	rganic co	ompo	ounds a	ınd th	e chei	nosele	ectivity	y of the
		reagents employed.									
CO2			nt reduction reactions of o	organic c	ompo	ounds a	and ex	xplain	the cl	nemos	electivity
		of the reagents emp	•								
CO3			emistry of carbonyl comp	ounds, o	lefin	s, conj	ugate	d poly	venes,	vision	, enones
		and singlet oxygen									
CO4		1	non and important organic						reage	nts use	ed.
CO5			reactions and distinguish		their						ı
Unit-No.		Con	tent	СН					come		KL
I		ation Reactions:		8		nowled	-				1,2
			tal based oxidations (Cr,			kidation				_	
		Al, Ag, Os, Ru, Se, DMSO, hypervalent ne and TEMPO based reagents), Reagents				mpour		ar		the	
					emose			of	the		
	•	· ·	arbonate, peroxides/per-		re	agents	empl	oyed.			
	acids		ymmetric epoxidation,								
		_	ni epoxidation, Sharpless								
	•	• •	lation, Baeyer-Villiger								
			idation, hydroboration-								
			action and Woodward trans- hydroxylation,								
	-	•	1 KMnO ₄ , OsO ₄ , HIO ₄ ,								
			tate, oxidation of allylic								
		bond using $SeO_2$ .	tate, oxidation of anytic								
II		iction Reactions:		8	K:	nowled	lae ah	out di	fferen	ıt.	1,2
11			ydrogenation, Wilkinson			duction	_				1,2
			nmetric hydrogenation,			mpour			_		
	-		using Li/Na/Ca in liquid			emose		-			
			gnesium, Zinc, Titanium			agents					
	and	_	h, Pinacol formation,			8	1	,			
		*	mation, dehalogenation								
			ydride transfer reagents								
			Group IV in reductions								
	(NaB	H ₄ triacetoxyborohy	vdride, L-selectride, K-								
	selec	tride, Luche reduct	ion, LiAlH ₄ , DIBAL-H,								
	and	Red-Al,	Trialkylsilanes and								
		kylstannane, Me	eerwein-Pondorff-Verley								
		luction); Stereo/enantioselective reductions									
(Chiral Boranes, Corey-Bakshi-Shibata).											
Ш	Orga	nic Photochemistr	y:	10	Le	earn a	bout	photo	chem	istry	1,2
			ganic photochemical-		of		bony		mpou		
	_		es, chemiluminescence,			efins,	-	-			
	photo	osensitization, Phot	ochemistry of carbonyl		vi	sion,	enoi	nes a	nd sir	nglet	

	compounds (α-cleavage, β-cleavage,		oxygen photochemistry.	
	intramolecular H-abstraction, addition to $\pi$ -		oxygen photoenemistry.	
	systems- Paterno-Buchi reaction);			
	Photochemistry of olefins (photostereomutation			
	of cis-trans isomers, optical pumping,			
	cycloaddition, photochemistry of conjugated			
	polyenes, photochemistry of vision),			
	Photochemistry of enones(Photo-rearrangement			
	reactions, di-π-methane rearrangement, Photo-			
	rearrangement of cyclohexadienones, Barton			
***	rearrangement); Singlet oxygen photochemistry.	_		1.0
IV	Organic Name Reactions:	5	Explain some common and	1,2
	Wohl- Ziegler reaction, Hunsdiecker, Barton,		important organic name	
	Birch reaction, Hofmann Lofler Freytag,		reactions along with the	
	Favorski, Stork enamine, Michael Addition,		reagents used.	
	Robinson Annulation, Mannich, Shapiro,			
	Chichibabin, Witig Reaction, Gilman Reagent,			
	DCC, LDA, 1, 3- dithane, trimethylsilyl iodide,			
	Baker's yeast, Phase transfer catalyst.			
V	Pericyclic Reactions:	14	Distinguish between the	1,2
	MO symmetry, FMO of conjugated polyenes.		different types of	
	Woodward-Hoffmann principle of conservation		pericyclic reactions and	
	of orbital symmetry, allowed and forbidden		thus describe in detail	
	reactions, stereochemistry of pericyclic		about pericyclic reactions.	
	reactions, orbital symmetry correlation method,			
	PMO method.			
	Cycloaddition reactions: 2+2, 4+2, 6+2			
	cycloadditions, 3+2 and 4+3 dipolar			
	cycloadditions; stereoselectivity of the reactions,			
	regioselectivity of 4+2 cycloaddition reaction.			
	Sigmatropic rearrangement: (m+n) sigmatropic			
	rearrangement of hydrogen and chiral alkyl			
	groups; Divinylcyclopropane rearrangement,			
	fluxional molecules, stereoselectivity in Cope			
	and Claisen rearrangement. Sommelet-Hauser			
	_			
	rearrangement.			
	Electrocyclic reactions and cycloreversions:			
	Conrotatory and disrotatory process,			
	Stereoselectivity of the reactions.			
	Linear and nonlinear cheletropic rearrangement,			
	theories of cheletropic reactions,			
	stereoselectivity of the reactions.			
	Ene reactions: of 1,7-dienes, carbonyl enophiles,			
	simple problems. Claisen rearrangement and its			
	variants, aza-Cope rearrangement (Overman			
	rearrangement), ene reaction (metallo-ene;			
	Coniaene).			
Practical	1. Synthesis of Organic compounds: (any	30	Apply knowledge of	1,2,3,4
	five to be performed mandatorily)		synthesis of organic	
	Benzopinacolone from benzophenone.		compounds and isolation	
	Benzilic acid from benzoin.		of natural products	
	Caprolactone from cyclohexanone.			
	Acetylation reaction			
	Coupling Reactionn			
	Diels Alder reaction			
	2. Isolation of natural products: (any five			
	2. Isolation of natural products. (any nive	I	İ	1

to be performed mandatorily)
Isolation of caffeine from tea leaves
Isolation of piperine from black
pepper.
Isolation of β- carotene from carrots.
Isolation of lycopene from tomatoes
Isolation of limonene from lemon
peel.
Isolation of euginol from cloves

- T1: March, J. Advanced Organic Chemistry: Reactions, Mechanisms, and Structure. 4th edition. Wiley; 2016.
- T2: Clayden, J., Greeves, N. and Warren, S. Organic Chemistry. 2nd edition. Oxford University Press; 2012.
- T3: Norman, R.O.C. and Coxon, J.M. Principles of Organic Synthesis. 3rd edition. Chapman & Hall; 2003.
- T4: Fleming, I. Oxford Chemistry Primers: Pericyclic Reactions. 2nd edition. Oxford University Press; 2015.
- T5: Vogel, A.I. Textbook of Practical Organic Chemistry. 5th edition Prentice Hall.

## REFERENCE BOOKS

R1: Bruice, P. Y. Organic Chemistry. 8th edition. Pearson; 2020.

R2: Horspool, W. M. Aspects of Organic Photochemistry. Academic Press.

## Other learning resources

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Identify the different oxidation reactions of organic compounds and the chemoselectivity of the reagents employed.	1, 2, 5, 7, 8				
2	Describe the different reduction reactions of organic compounds and explain the chemoselectivity of the reagents employed	1, 2, 5, 7, 8				
3	Explain the photochemistry of carbonyl compounds, olefins, conjugated polyenes, vision, enones and singlet oxygen photochemistry	1, 7				
4	Explain some common and important organic name reactions along with the reagents used.	1, 2, 5, 7				
5	Describe pericyclic reactions and distinguish between their different types.	1				

	SEMESTER – II									
<b>Course Title</b>		Phys	sical Chem	istry-II						
Course code	24MSCH1203R	<b>Total credits: 4</b>		L	T	P	S	R	O/F	C
		Total hours: 45T+	-30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requ	isite				N	il		
Programme		Master of S	Science in (	Chemistr	y					
Semester	S	Spring/ II semester of First year of the programme								
Course	1. To study the	e chemical reactions	at the surfa	ices and in	nterf	aces	betv	veen	two	
Objectives	materials.									
	2. To understa	nd the theories of en	zyme kinet	ics, mech	anisı	ns o	f enz	zyme	catal	ysed
		d their regulation in								
		knowledge of differ	ent distribu	tion laws	and	their	stat	istica	al	
	•	mic studies.								
		e ideal gas law in sto	oichiometry	problems	s in v	vhic	h ch	emic	al reac	ctions
	involve gas									
		antum mechanics of	molecules	and chem	nical	bon	ding	usin	g Bori	n-
		er approximation.								
CO1		mistry phenomena a	nd fundam	entals of t	the c	hem	istry	occi	ırring	at
	surfaces and interface									
CO2	-	of enzymatic and fa								
CO3	•	stribution laws and the			•					. 1
CO4		gy and macroscopic	_	from parti	tıon	func	tion	and	apply	them
		paramagnet, ideal gas								
CO5		eterminants, term sy			_					
Unit-No.	Con	tent	Contact	Lea	rnin	g O	utco	me		KL
	Conformation		Hour	IZ	1.1.					1.2
I		capillary action,	10	Know	_					1,2
		interface: Laplace vin equation;		_	capillary action, adsorption					
		id systems: Gibbs		phenor		<b>\n</b> 01	ad.			
		m. Adsorption on		discus						
	_	isotherm, BET								
		al properties of		various isotherms. Interaction related to						
		, coagulation of		different types of						
	colloidal sols.			surfact	-	_	01			
	1	ro-osmosis, size		Barrae	carres	•				
		colloidal particles.								
		assification of								
	· ·	phobic interaction,								
		nicellization of								
		oilization, critical								
		ion (cmc), reverse								
	micelles, factors	affecting the cmc,								
	microemulsion.	-	´							
II	Effect of ionic str	ength, Kinetic salt	8	8 Knowledge on the kinetic			etic	1,2		
	effect. Enzyme	catalysis and		study of	diff	eren	t en	zyma	atic	
	Michaelis-Menton	Mechanism,		reaction	s.					
	enzyme inhibitio	n. Treatment of								
	unimolecular read	etions: Lindemann								
	mechanism, RRK	M theory, electron								
	transfer reactions	. Fast reactions,								

III	study of fast reactions by flow method, relaxation method, flash photolysis, nuclear magnetic resonance method, kinetic isotopic effect.  Concept of distribution, Thermodynamic probability and most probale distribution. Canonical and other ensembles. Statistical mechanics for systems of independent particles.  Maxwell Boltzman, Bose Einstein and Fermi Dirac statistics. Idea of microstates and macro states. Themodynamic probality for the three types of statistics. Derivation of distribution laws for the three types of statistics.	7	Knowledge on different distribution laws and their statistical thermodynamic studies.	1,2
IV	Molecular partition function and its factorization. Evaluation of transitional, rotational and vibrational partition functions for monatomic, diatomic and polyatomic gases. Calculation of thermodynamic properties of ideal gases in terms of partition function.  Statistical Entropy: Statistical definition of entropy, ortho and para hydrogen, symmetry number. Calculation of equilibrium constants of gaseous solutions in terms of partition function, of gas mixtures.	15	Knowledge on the determination of free energy and macroscopic quantities from partition function.	1,2
V	Chemical Bonding: Born Oppenheimer approximation, Variation theorem, linear variation principle and perturbation theory, applications of variation method and perturbation theory, antisymmetry, Slater determinant, term symbols and spectroscopic states.	5	Knowledge on approximation method, Slater determinants, term symbols and spectroscopic states.	1,2
Practical	<ol> <li>Study the variation of viscosity of nitrobenzene with temperature, and determine the temperature coefficient of viscosity of nitrobenzene.</li> <li>Determine the limiting cross-section area of n-propyl alcohol by surface tension measurements.</li> <li>Determine the critical micelle concentration of sodium dodecyl sulphate in aqueous medium by</li> </ol>	30		1,2,3,

- surface tension measurements.
- 4. Determine the distribution coefficient of iodine between CCl₄ and water at a given temperature.
- 5. Determine the equilibrium constant of the reaction  $KI + I_2 \stackrel{k}{\Leftrightarrow} KI_3$  by distribution method.
- 6. Determine the distribution coefficient of succinic acid between ether and water.
- 7. Determine the formula of the complex formed between the cupric ion and ammonia by distribution method.
- 8. Determine the strength of the components of the mixtures: (i) HCl and acetic acid, (ii) H₂SO₄ and CuSO₄.
- 9. Determine the amount of components of the following mixtures: (i) HCl and acetic acid, (ii) HCl and oxalic acid, (iii) KCl and KBr and KI.
- 10. Determine potentiometrically the strengths of solutions of HCl and acetic acid individually and a mixture of the two using standard NaOH solution.
- 11. Titration of ferrous ammonium sulphate against potassium dichromate and determine the standard electrode potential of the ferrous/ferric system.

- T1. Physical Chemistry (Vol.1 & 2), K.L. Kapoor, Macmillan, 2001.
- T2. Atkins Physical Chemistry, Peter Atkins and Julio D Paula, Oxford University Press, 2006.
- T3. B.K. Sen, Quantum Chemistry Including Spectroscopy. Kalyani publishers (2001).

#### **REFERENCE BOOKS:**

- R1. Chemical Kinetics, Keith J. Leidler, Pearson, 2003.
- R2. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma, Madan S. Pathania, Vishal Publishing Company, 2008.
- R3. Advanced Physical Chemistry, Gurdeep Raj, Krishna Prakashan Media (p) ltd, 2011.
- R4. Pathria, R.K., Statistical Mechanics, Butterworth-Heinemann, (1996).
- R5. Yadav, J.B. Advanced Practical Physical Chemistry. KRISHNA Prakashan Media (P) Ltd; 2012.

R6. Das, R.C. & Behera, B. Experimental Physical Chemistry. Tata McGraw-Hill Publishing Company Limited.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Discuss surface chemistry phenomena and fundamentals of the chemistry occurring at surfaces and interfaces	1, 2, 7				
2	Explain the kinetics of enzymatic and fast reactions	1, 2, 3, 5, 7				
3	Explain different distribution laws and their statistical thermodynamic studies.	1, 2, 6, 7				
4	Determine free energy and macroscopic quantities from partition function and apply them to simple systems (paramagnet, ideal gas, etc.).	1, 6, 7				
5	Discuss the Slater determinants, term symbols and spectroscopic states.	1				

Course Title	Research Methodology and Statistical Analysis								
Course Code	Totalcredits:3		L	T	P	S	R	O/F	C
Course Code	24MSCH1205R Total Hours: 30T & 15P	2	0	2	0	0	0	3	
Pre-Requisite	NIL	CO-REQUISITE		NIL					
Anti-Requisite	NIL								
Programmes	All PG Programme								
Semester	First Year, Winter Semester								

## **Course Objectives**

- 1. The course aims to enhances the students' a broad understanding of research methodology, including theory of science and qualitative and quantitative methods in research.
- 2. The course seeks to enhance the students' skills for developing critical thinking through research literature review in different domain. Consequently it aims to develop skills for preparation of a research proposal for a master' thesis project/Mini research.
- 3. To develop Students competency in planning, conducting, evaluating and presenting a research project.

#### **Course Outcomes**

- 1. Students will have basic knowledge of Research methods.
- 2. Students will gain the knowledge of Research Methodology.
- 3. Students will be able to gain the Skill questionnaire development. Students will be able to acquire the knowledge of basic Report/dissertation Procedure.
- 4. Students will be able to plan, organize, and structure research reports, theses, and dissertations using appropriate formatting, citation methods, and statistical presentation techniques, including tabular and graphical representations.
- 5. Students will acquire knowledge of various aspects of IPR, including patents, trademarks, copyrights, industrial designs, traditional knowledge, and geographical indications.

#### **Course Description**

This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. Includes computer applications for research.

#### References

- 1. Boyle JS. Styles of ethnography. In: JM Morse, editor. Critical issues in qualitative research methods. Thousand Oaks, CA: Sage, 1994:159–85.
- 2. Coughlan M., Cronin P. and Ryan F. (2007). Step-by-step guide to critiquing research. Part 1: quantitative research. British journal of Nursing 16 (11).
- 3. Creswell, JW. (1998). Qualitative Inquiry and Research Design Choosing Among Five Traditions. Thousand Oaks, CA: Sage Publications.
- 4. Crotty, M. (1998). The Foundations of social research: Meaning and perspective in the research process. London: Sage.
- 5. Denzin, NK. (1978). Sociological Methods. New York: McGraw-Hill.
- Hanson WE, JW Creswell, VL Plano Clark, KS Petska and JD Creswell. Mixed Methods Research Designs in Counseling Psychology. Journal of Counseling Psychology, 2005, Vol. 52, No. 2, 224–235. http://www.preciousheart.net/chaplaincy/Auditor Manual/13casesd.pdf
- 7. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn & Bacon.
- 8. Kothari C., R. (2004). Research Methodology: Methods and Techniques. New Delhi. New Age International (P) Limited, Publishers.
- 9. Krueger, A. R. (1994). Focus Groups: A Practical guide for Applied Research, Thousand Oaks, CA: Sage Publications

- 10. L., L. Espinosa and M. Yamashita (2015). Evaluation Toolkit. Evaluation Guide. Analyze Data. Retrieved from: http://toolkit.pellinstitute.org/evaluation-guide/analyze/analyze-qualitative-data/
- 11. Neuman, W. L. (2000). Social research methods. Qualitative and Quantitative approaches (4th Ed.). Boston: Allyn and Bacon.
- 12. Patton, MQ. (1999). "Enhancing the quality and credibility of qualitative analysis." HSR: Health Services Research. 34 (5) Part II. pp. 1189-1208.
- 13. Patton, MQ. (2001).Qualitative Evaluation and Research Methods (2nd Edition).Thousand oaks, CA: Sage Publications.
- 14. Strauss, A. & Corbin, J. (1994). "Grounded Theory Methodology." In NK Denzin & YS Lincoln (Eds.) Handbook of Qualitative Research (pp. 217-285). Thousand Oaks, Sage Publications.

#### Unit-1

Research Methodology- An Introduction- meaning and objectives of research, motivation in research, types and significance of research, criteria of good research. Defining the Research Problems- definition of research problem, necessity of defining research problem

#### Unit-2

Research Design- meaning and need of research design, features of a good design, different research designs, Sampling Design- steps in sampling design, Sample Size determination, criteria for selecting a sampling design, different types of sampling design, Experimental Design, Principles of Design of Experiment, One – way ANOVA, Two- Way ANOVA, CRD, RBD, LSD, 2², 2³ Factorial Design

#### Unit-3

Types of data, sources of data collection, tools of data collection, Nominal, ordinal, interval and ratio – Attitude scale construction and measurement, rating scales, semantic differential (SD), Use of scale in statistical analysis, Schedules for interviews preparation and standardization, development of survey instruments and item analysis for the questionnaire

#### Unit-4

Planning and organizing research report, Format of research report, Different steps of writing report, layout of the research report, How to organize thesis/Dissertation, mechanics of writing research report, standard methods of quoting- presenting the result, written and oral reports, Uses of abstract, format of research report, presentation of statistics - tabular and graphic references and uses of references, Bibliography and presentation of bibliography

#### Unit-5

Intellectual property right (IPR), Introduction and the need for IPR, IPR in India and worldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications, Patentable and non-patentable, patenting life, Filing of a patent application, The different layers of the international patent system, Case studies on Basmati rice, Turmeric, and Neem patents

## **Laboratory using R Software:**

- 1. Analysis of One way ANOVA;
- 2. Analysis of Two way ANOVA;
- 3. Analysis of CRD
- 4. Analysis of RBD
- 5. Analysis of 22 and 23 Factorial Experiment
- 6. Simulation-I using R (Bernoulli, Binomial, Poisson and Geometric distribution).

- 7. Simulation-II using R (Exponential and Normal distribution).
- 8. Simple random Sampling
- 9. Stratified Random Sampling

			Theory	Practical
ent	Internal (Daily lab Exercises	Marks	20	20
l ŭ	+Pre final test)	% (weightage)	25	25
dw	External (Sem End Exam)	Marks	30	30
్రి		% (weightage)	25	25

# RELATIONSHIP BETWEEN THE COURSE (COs) AND PROGRAMME OUTCOMES (POs)

	Mapping between Cos and POs					
Sl No	Course Outcomes (COs)	Mapped Programme Outcomes				
1	Students will have basic knowledge of Research methods.					
2	Students will gain the knowledge of Research Methodology.					
3	Students will be able to gain the Skill questionnaire development.					
1	Students will be able to acquire the knowledge of basic					
7	Report/dissertation Procedure.					

		Concepts of	Concept of Sampling	Methods of Data	Concept of	Determinat ion of	Concept of Scaling	Skill of Reliability	Skill of	Concept of Intellectual	Concept of Patents	Use of Plagiarism	Life Long Learning
		1	2	3	4	5	6	7	8	9	1	1	12
											0	1	
24MSCH1205R	Research												
	Methodol												
	ogy and												
	Statistical												
	Analysis												

¹⁼Addressed to small extent

²⁼ Addressed Significantly

³⁼Major part of the course

		SE	MESTER	k-II							
Course Title		Data .	Analysis l	Using	Micr	osoft E	xcel				
Course code	24FSDA1201R	Total credits:	: 2	L	T	P	S	R	O/F	C	
		Total hours: 3	0P	0	0	2	0	0	0	2	
Pre- requisite	Nil	Co-requi	isite				Ni	il			
Programme			Maste	er of S	Scienc	e					
Semester		Spring/II ser	nester of	First	year (	of the P	rogra	mme			
Course	1. The cour	rse aims to en	hances the	e stud	ents'	a broac	l unde	rstanc	ling of	Microsof	
Objectives	Excel, in	cluding theory	of Statisti	cs.							
	2. The course seeks to enhance the students' skills for developing practical thi										
	through excel in different domain. Consequently, it aims to develop skil										
	preparation of a developing practical skill in the field of statistics.										
CO1	Students will have										
CO2	Students will gai	-	•								
CO3	Students will be	able to gain the	Skill to c	alcula	te me	an, med	lian, m	ode o	r other.		
CO4	Students will be	-	the knowl	edge (	of cor	relation	and re	egress	ion usin	g	
	Microsoft Excel.										
CO5	Knowledge on fi	tting of a distri	bution usi	ng Mi	crosof	ft excel.					
Unit no	Cont	ent	Contact	L	earni	ing Outcome				BL	
			Hours								
I	Introduction to	Microsoft	5	Unde	Understanding ribbons, menus, and						
	Excel for Data	-							ets, and		
	(Organization a	nd Cleaning)		cells,					matting		
				Impo			rom	othe		ļ	
				_		n, pivot		•			
II	Data Analysis	Tools	6			les an			-	1,2	
	and Tech	niques			_	Statis					
						ndency:					
				Mode		easures			-		
						eviation					
III	Advanced Exce			_		ctions:				1,2	
	and Data Visual	lization				•	pes: E	Bar, Li	ne, Pie,		
				Scatte							
IV	Regression Ana	•			_	_			lel using	1	
	Model Building	;					_		output		
				Slope		tercept			edictive		
						ing the r					
V	Probability and	Inferential		Using	,	Excel'			Л.DIST,	2,3	
	Statistics					IST, an	d P OI	SSON	I.DIST		
				functi	ons						

## **Textbooks**

T1: Mastering Advanced Excel, Ritu Arora, BPB publishers.

T2: Microsoft Excel Formulas and Functions, Paul Mc. Fedries, Pearson Education

## Reference books

R1: Data Analysis with Excel, Manisha Nigam, BPB Publications; First Edition (5 September 2019).

R2: Basic Statistics by B.L. Agarwal, New age international limited.

		SEMESTER -	- III						
Course	<b>Fitle</b>	Symmetry and	l Grou	p Theor	y				
Course c	ode 24MSCH2101R		L			R O/F	С		
		Total hours: 45T	3	0	0 0 0	) 0	3		
Pre-requ	isite Nil	Co-requisite			Nil				
Program	ime	Master of Sc	ience i	n Chem	istry				
Semest	er F	Fall/III Semester of Se	cond Y	ear of t	he Progran	ıme			
Cours	se 1. To unders	tand the basic concept	of matr	ices.					
objecti	ves 2. To gain k	nowledge on the differe	nt symi	metry ele	ements and o	perations.			
		tand how point groups							
		tand and apply the kno	wledge	of diffe	rent symme	try operation	ıs in		
	I	ecular systems.							
CO1		trix and elements of gro							
CO2	-	etry elements, point gro	_		-		S		
CO3		rent character tables as							
CO4	•	ion rules for different v			encies using	g symmetry.			
COS		ing of complexes using	group		_				
Unit-No.	Content			СН	_	the basic	KL		
I	_	atrices and Groups: 8 Gain the							
		ry, definitions and elem	ents of		_	on groups,	1,2		
	group theory.				formati				
	35.1	Molecular symmetry and symmetry groups				matrices. Understand the			
II				12					
	1 -	nmetry elements and symmetry operations, sses of symmetry operation, Symmetry point				ry elements			
			nτ		and syn	•	1,2		
	groups, Assignment of	Symmetry of s, p and c	1		operation associate				
	orbitals.	Symmetry of s, p and c	l		molecul				
III	Representation of gro	uine		16		owledge of	2,3		
111		of symmetry operations	The	10	the grea	•	2,3		
	Great Orthogonality Tl		, THC		orthogo				
	Irreducible representati		and		theorem	•			
	_	eter tables (C2v, C3v ar				anding the			
	C2h).	(221, 231 a)				t character			
	(211)				tables.				
IV	Applications of Grou	p Theory and Symmet	rv	12		tion of the	2,3		
	••	determining symmetry	•		1	er tables in			
	of normal modes of vib				underst	anding the			
	examples, Selection ru	les for Fundamental			differen	t			
	Vibrational Transition	(IR and Raman).			vibratio	nal			
					transitio	ons.			
V	Symmetry bonding of	f molecular orbitals		12	Unders	tand the	2,3,4		
	Symmetry properties of	f atomic orbitals, molec	cular		bonding	g of atomic,			
	orbitals for $\sigma$ and $\prod$ be	onding in AB4 molecule	s, MO		molecu	lar orbitals.			
	treatment of the bonding	ng in ferrocene. Ligand	field						
	states, construction of	the correlation diagram	for the						
	d ² configuration in an o	octahedral environment	•						

T1: F. A. Cotton, Chemical Applications of Group Theory, 3rdEdition, Willey India Pvt. Ltd. 2008.

## REFERENCE BOOKS

R1: R. L. Carter, Molecular Symmetry and Group Theory, John Wiley & Sons, 1998

## OTHER LEARNING RESOURCES

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Determine the matrix and elements of group theory.	1, 5,6							
2	Identify the symmetry elements, point groups and different symmetry operations.	1, 5,6							
3	Identify the different character tables associated with various point groups.	1, 5,6							
4	Identify the selection rules for different vibrational frequencies using symmetry.	1, 5,6							
5	Analyze the bonding of complexes using group theory.	1, 5,6							

C Trivi		SEMESTE								
Course Tit			emistry		/m				0/5	
Course cod	le 24MSCH2106R	Total credits: 4 Total hours: 45T+3	0P	1 L 3	T 0	P 2	S 0	R	O/F 0	C 4
Pre-requisi	te Nil	Co-requisi					Nil			•
Programm		Master of S		hemis	trv		- 1,11			
Semester		Fall/ III semester of S			•	ramm	ie			
Course		nts recall about the d						ved in	n the	human
Objectives			• • • • • • • • • • • • • • • • • • • •							
	2. To make the stu	idents learn in detail al	bout the ch	emistry	of bio	organ	ic mol	ecule	s.	
	_	meaning of essential		ssentia	l biolo	gical	eleme	nts, th	e tox	icity of
		in biological processe								
	-	udents in identification	on of the c	lifferen	nt met	als pr	esent i	n me	tallop	roteins,
G04	enzymes.	1 1 1	1							
CO1	Describe in detail about			1 1 '	٠, ٠,	C		. 1		
CO2	Explain amino acids, pro		_				mino a	icids.		
CO3	Describe vitamins, horm Explain the meaning of	•					l the to	vioit	, of A	ifferent
04	metals in biological proc		Ciitiai viole	igical 6	Jenier	us allC	i iiie l(	AICIL	yord	111616111
CO5	Identify the different me		proteins and	d enzvi	nes					
Unit-No.	Conter		Contact			ning	Outco	me		KL
			Hour			8				
I	Carbohydrates: Cl	assification of	10	Lea	arn abo	out car	bohydr	ates		1,2
	carbohydrates, deoxy sug	gars, amino sugars,			and li	pids in	detail.			
	branched chain sugars, sug	·								
		sugars, biological								
	importance of carbohydrat									
	Lipids: Classification									
		roperties of lipid								
	aggregates, micelles, bila									
	biological importance of li		10	T. 1		• 1			• 1	1.2
II	Amino acids and Pro Classification, Physical		10				on am			1,2
	properties of Amino			prot	C1115, 11	ucicic	acius	III act	a11.	
	synthesis of peptides and p	•								
	of polypeptides chain, as									
	determination, structur	-								
	biosynthesis of protein	1 /								
	diagnostic applications of									
	Nucleic acids: Purine an									
	and their biosynthesis,									
	nucleotides, structure of	DNA and RNA,								
	Stabilizing forces, replic	ation of DNA and								
	mutagenesis. Codon,	anticodon, tRNA,								
	structure and genetic cod	_								
	translation. Biological imp	ortance of DNA and								
***	RNA	J	40			1	1_1			1.2
III	Vitamins, hormones	and enzymes:	10		-		wledge			1,2
	Classification, occurrence			V1			nones	aIIU		
	vitamins, synthesis and b (deficiency syndromes).	iological illiportance			,	enzym	108			
	Introduction and classific	ation of Hormones								
	mechanism of action o	·								
	ACTH, Insulin, glucagon,	*								ļ
	Introduction, definition									
	classification of enzyn									
	oracomication of chizyll	100, properties of		<u> </u>						

	enzymes, mechanism of action of enzymes, cofactors, coenzymes.			
IV	Essential and non-essential elements in biosystems, different aspects of organo-transition metal complexes in bioinorganic chemistry. Poisioning effect due to non-metals, toxic effects of oxides of carbon, nitrogen and sulphur. Acid rain, poisioning effect due to Nitrite, CFC's and O ₃ layer depletion, Na/K pump, crown ethers, Toxicity of Hg, Cd, Pb.	7	To understand the basic concept of organotransition metal complexes within the living body.	1,2, 3,4
V	Hemeproteins, Fe-S proteins and Enzymes Haemoglobin and myoglobin, hemerythrin, ferritin and transferrins, 43eroxidase, catalase, cytochrome P-450. Fe-S proteins: rubredoxin and ferredoxins. Cytochrome C oxidase and superoxide dismutase, ceruloplasmin, vitamin- B12, carbonic anhydrase, carboxypeptidase and metallothionins, Biological nitrogen fixation, photosystem I and II in cleavage of water.	8	To gain knowledge about the functioning and application of different metalloproteins, enzymes present in the living systems.	1,2,3
Practical	1. Quantitative analysis:  (i) Estimation of glucose by chemical methods.  (ii) Estimation of amino acids by chemical methods.  (iii) Estimation of nitro group in organic compounds.  (iv) Estimation of carbohydrates, amino acids, proteins and caffeine by uvvisible spectra.  (v) Estimation of ascorbic acid by chemical or UV method.  2. Study of Enzymatic reaction:  (i) Reduction of ethyl acetoacetate with Baker's yeast  (ii) PPL catalysed deacetylation of 2,4-diacetoxyacetophenone.	30	Estimation of amino acids, nitro group, biomolecules like carbohydrates, proteins, vitamins and caffeine by chemical and spectroscopic methods, study of enzymatic reactions.	1,2, 3,4

T1: Nelson, D. L. and Cox, M. M. Lehninger Principles of Biochemistry.4th edition. Macmillan Publishers.

T2: Huheey, J. E., Keiter, E. A. and Keiter, R. L. Inorganic Chemistry: Principles of Structure and Reactivity. 4th edition. Pearson Education, 2006.

## **REFERENCEBOOKS:**

R1: Conn, E. E., Stumpf, P.K., Bruening, G., Doi, R. H. Outlines of Biochemistry. 5th edition. Wiley; 2007.

## **OTHERLEARNINGRESOURCES:**

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe in detail about carbohydrates and lipids.	1, 5,6						
2	Explain amino acids, proteins and nucleic acids along with classification of amino acids.	1, 5,6						
3	Describe vitamins, hormones and enzymes and explain their differences.	1, 5,6						
4	Explain the meaning of essential and non-essential biological elements and the toxicity of different metals in biological processes.	1, 5,6						
5	Identify the different metals present in metalloproteins and enzymes	1, 5,6						

	SEMES	TER-III					
Course 7	Title S	pectrosco	py				
Course	code 24MSCH2107R Total credits: 4	L	T P	S	R	O/F	C
	Total hours: 60T	4	0 0	0	0	0	4
Pre-requ	_				Nil		
Progran		of Science in					
Semest						1 1 .	1.1
Cours		-	_	-	ctrum ar	nd understa	ind the
Objecti	selection rules for rotational and 2. To understand the working and m		-		rosconv	,	
	3. To gain knowledge on Mass, Mos			_			or.
	inorganic molecules.	souder speed	овсору и	na try to	, sorve t	orooiems i	<i>7</i> 1
CO1		rules for rota	tional, vi	brationa	l spectro	oscopy.	
CO2						10	
CO3					roscopy	· .	
CO4	Identify the mass fragments of different r	nolecular sys	tems usii	ng mass	spectros	scopy.	
CO5		d distinguish	the effe	ct of iro	n, tin c	ompounds	using the
	technique						
Unit-	Content	Contact	]	Learnin	g Outco	ome	KL
No.		Hour	TT 1	. , 1.1		•	1.2
I	Introduction to Spectroscopy	12	1	rstand tl		ıng	1,2
	Electromagnetic spectrum, Interaction of electromagnetic spectrum with matter, Line		1	ctromag rum and		\n	
	width and broadening, Doppler effect.		1 -	for rotat			
	Selection rules. Rotational Spectroscopy:			tional sp			
	Microwave region, Selection rule for					-17	
	microwave spectroscopy, Rotational levels						
	of heteronuclear molecules, Isotopic						
	substitution,						
	Vibrational Spectroscopy:						
	Fundamental Vibrational frequencies,						
	Selection rules for harmonic and						
	anharmonic oscillators, Fundamental overtone and combination bands P, Q, R						
	branches, hot bands.						
II	Electronic spectroscopy:	12	Unde	rstand tl	ne select	tion	1,2
	UV-visible spectroscopy: Electronic	12				ansition	-,-
	transitions, Franck-Condon principle,			nderstar			
	Selection rules, parity, symmetry and spin		mole	cules ba	sed on n	nutual	
	selection rules. Fluorescence and		1	sion pri	-	nowing	
	phosphorescence spectroscopy: Jablonski		Rama	ın effect			
	Diagram, quantum yield, fluorescence						
	quenching, Instrumentation and						
	applications.  Raman effect:						
	Quantum theory of Raman effect, Selection						
	rules, mutual exclusion principle						
III	NMR Spectroscopy:	12	Unde	rstand tl	ne basic	principle	1,2
	Chemical shift, factors contributing to			MR, ESI			
	chemical shift, spin-spin coupling and its				_	oncept of	
	implication to structure determination;		hyper	fine, ze	o conce	ept	
	simplification of complex spectra; Use of		splitt	ing of di	fferent 1	molecules.	
	³¹ P and ¹⁹ F NMR in coordination chemistry:						
	metal-ligand interaction; isomer						
	determination.						
	ESR Spectroscopy:		<u> </u>				

	Principle, resonance condition, Origin of g-value, spin orbit coupling, Kramer degeneracy, zero-field splitting, hyperfine &super hyper interaction, line width and application of ESR in organic radicals and transition metal coordination complexes.			
IV	Mass Spectroscopy:  Ion fragmentation mechanism, Base peak and molecular ion peak, metastable peak, instrumentation and techniques, ionization methods, isotopic distribution, Application in determining the structure of organic and inorganic compounds	12	Understand and then identify the different ion fragments and apply the technique for various molecular systems.	1,2
V	Mossbauer Spectroscopy:  Principle of Mossbauer spectroscopy, Instrumentation, Application of Mossbauer spectroscopy: The isomer shifts, magnetic interaction, quadruple splitting, line with. Application to iron to iron and tin compounds.	12	Knowledge on the principle, instrumentation and application of Mossbauer spectroscopy.	1,2, 3,4

- T1. C. N. Banwell, E.M. McCash, Fundamentals of Molecular Spectroscopy,3rd Ed. Tata McGraw Hills
- T2. G. M. Barrow, McGraw Hill, Introduction to Molecular Spectroscopy.

## **REFERENCE BOOKS:**

- R1. D.L. Pavia, G. M. Lampman, G. S. Kriz, Introduction to Spectroscopy, 4th Ed., Cengage, 2001
- R2. R. S. Drago, Physical Methods in Chemistry, 1992T1. Environmental Microbiology by Eugene L Madsen

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain the basic principle and selection rules for rotational, vibrational spectroscopy.	1, 5,6							
2	Explain the molecules based on electronic spectra and Raman effect.	1, 5,6							
3	Explain the mechanism and working technique of NMR and ESR spectroscopy.	1, 5,6							
4	Identify the mass fragments of different molecular systems using mass spectroscopy.	1, 5,6							
5	Explain the Mossbauer spectroscopy and distinguish the effect of iron, tin compounds using the technique	1, 5,6							

		SEMESTER	R-III								
Course Ti	tle	Environmental an		n Che	mistry						
Course co	de 24MSCH2108R	Total credits: 4	L	T	P	S	R	O/F	С		
		Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requis	site Nil	Co-requisite				N	Vil				
Programi	ne	Master of S	cience i	n Che	mistry						
Semeste		Fall/ III semester of S									
Course		the basic concepts abou			nmental	cher	nistry,	its defin	ition and		
Objective		n of various terms, segmen									
		<ol><li>To discuss the chemistry behind toxicity and hazards chemicals reactions on macro and microorganisms.</li></ol>									
					1 .	1 11	,.	1.1 .	1		
		<ul><li>3. To assess the reason behind the atmospheric, water and soil pollution and their remediation.</li><li>4. To evaluate the sources of solid waste, their Classification, and prepare a Management</li></ul>									
		Plan.									
		5. To give knowledge on the principles of green chemistry, synthesis of less hazardous and									
	_	safer chemicals.									
CO1		tal Chemistry, and explain	the var	ious te	rms, se	gment	s and c	vcles.			
CO2		behind toxicity and hazardo							ganisms.		
CO3	_	affecting the atmospheric,									
CO4	_	of solid waste, their Class									
CO5		es of green chemistry, syn		_			_				
Unit-No.	Cor	ntent	Contac	et	Le	arning	g Outco	ome	KL		
			Hour								
I	Concept and scope o		8		Knowle	_			1,		
	Chemistry: Definitio	•		- 1	concept				2		
	of various terms, seg				Chemis	-					
	environment, princip	les and cycles in			explana						
	the environment.				environ			-			
	m : : 11 1	C1 · · · · · · · · · · · · ·			segmen						
II	Toxicity and hazards	-	7	1	Knowle chemist	_			1, 2		
	various organic and i materials and their el	_			and haz	•		•			
	to chemical hazards				reaction			_			
	environmental effect	•			microo			iid			
	microorganism, indu				11110100	Summ					
III	Atmospheric pollution		10		Knowle	edge al	out the	;	1, 2		
	smog, industrial poll				Atmosp	-					
	depletion, global war	rming and their			pollutio						
	minimisation.				remedia	tion.					
	Water pollution: Eut	rophication, ground									
	water contamination										
	fluoride, toxic heavy										
	remediation. Drinkin	g water									
	contamination.	11 1									
	Soil pollution: Soil p										
	industrial disposal ar including pesticides										
	fertilizers, remediation	-									
	lands.	on or agricultural									
IV	Solid Waste Manage	ment Plan. Waste	10	+	Knowle	edge or	1 the So	olid	1, 2		
	minimization technol		10		Waste N	-			1,2		
	Waste Management,	_			Sources	_					
	Classification, physic				Waste n						
	properties, Hazardou				technolo						
	Treatment					-					
V	Green Chemistry: Pr	inciples of green	10		Knowle	edge al	out the	;	1, 2		

	chemistry, less hazardous chemical synthesis, designing safer chemicals, solvents and auxiliaries, design for energy efficient techniques, renewable feedstocks, catalysis, design for degradation, real time analysis for pollution prevention and design for green synthesis.		Principles of green chemistry, synthesis of less hazardous chemical, designing safer chemicals, solvents and auxiliaries.	
Practical	<ol> <li>Nitration of Salicylic acid using ceric ammonium (green chemistry approach)</li> <li>Benzil-benzilic acid rearrangement</li> <li>Organic preparations (any two from each):         <ul> <li>Bezoylation of organic compounds: amines (aniline, toluidines, anisidine) and phenols (phenol, β-naphthol, salicylic acid) by green chemistry approach.</li> </ul> </li> <li>Aldol condensation using green method</li> </ol>	30	Students learn the alternative greener methods for the organic reactions and synthesis.	1 2 3 4

- T1. Manahan, S. E. Environmental Chemistry, 9th edn., (CRC Press 2009).
- T2. Anastas, P.T. & Williamson, T.C. Green Chemistry: Designing Chemistry for Environment, (ACS, 2000).

## **REFERENCE BOOKS:**

- R1. Solid Waste Management CPCB. New Delhi.
- R2. Ecotechnology for pollution control & environmental management By R.K. Trivedi & Arvind Kr.
- R3. Basic Environmental Technology J.A. Nathanson.

#### **OTHER LEARNING RESOURCES:**

https://nptel.ac.in

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Define Environmental Chemistry, and explain the various terms, segments and cycles.	1,5,6,7						
2	Explain the theory behind toxicity and hazardous chemical reactions on macro and microorganisms.	1,5,6,7						
3	Explain the factors affecting the atmospheric, water and soil pollutions and their remediation.	1,5,6,7						
4	Identify the sources of solid waste, their Classification, and prepare a Management Plan.	1,5,6,7						
5	Explain the principles of green chemistry, synthesis of less hazardous and safer chemicals	1,5,6,7						

		SEMESTER-	Ш							
<b>Course Title</b>			Chemistry							
Course code	24MSCH2110R	Total credits: 4		L	T	P	S	R	O/F	C
		Total hours: 45T+30	)P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite	2				Nil			
Programme		Master of Scie		emist	ry					
Semester	Fa	all/ III semester of Sec			•	gran	ıme			
Course		l be introduced to the			•	_		unct	ion of	food
<b>Objectives</b>		on of deficiencies.	•				ŕ			
Ū	2. Aspects rela	ted to various classes	naturally o	ccurri	ng c	hem	ical s	peci	es/add	itives
	their isolation	their isolation, characterization and synthesis will be discussed								
CO1	Explain the basic co	ncepts of food & nutrie	nts							
CO2	Describe Food group									
CO3		needs during life cycle								
CO4	Summarize Preventi	on and management of	deficiencie	S						
CO5	Explain Dietary goal	_								
Unit-No.		ntent	Contact	Le	arni	ng C	utco	me	K	L
			Hour			Ü				
I	Basic concepts of f	ood & nutrients:	12	Stud	lents	will	be a	ble	1, 2	
	Understanding the r	elationship between		to explain the basic						
	food, nutrition & he	alth. Functions of		con	cepts	of f	ood a	&		
	food—Physiologica	l & Social		nutrients						
	Functions, dietary s	ources and clinical								
	manifestations of de									
	following nutrients:									
	Proteins and Amino	Acids,								
	Carbohydrates, Lipi	ds, Sterols &								
	metabolites, Minera	ls, Vitamins : Fat								
	soluble vitamins (A	, D, E, K)								
	Water Soluble Vitar	nins (Thiamine,								
	Riboflavin, Niacin,	Biotin, Pyridoxine,								
	Cyanocobalamin), (	-								
	Compounds of nutri									
	(Cholin, Cysteine, C	Carotenoids)								
II	Food groups		8				n abo	out	1,	, 2
	Selection, nutritiona					_	on of			
		king/Ripening/storage		food	d gro	ups				
	of the following gro	•								
	Cereals, Pulses, Fru	•								
	Milk and milk prod									
	Poultry & fish, Fats									
III	Nutritional needs		8				able		1,	, 2
		Influence of Nutrition,					utriti	onal		
	Physical Activity, C					ıring	life			
	Maternal Nutrition,			cycl	e					
		Infancy, Childhood								
	Diet, Nutrition and									
	Nutrition in the Eld	•								
IV	Prevention and ma	nagement of	9	Stu	dent		rn to		1,	, 2
	deficiencies						bout			

	Causes, Symptoms, Treatments,		prevention and	
	Prevention of the following: Protein-		management of	
	Energy Malnutrition(PEM) amongst		deficiencies	
	Children, Vitamin A-Deficiency (VAD),			
	Iron Deficiency Anemia (IDA),			
	Fluorosis: Over nutrition: Obesity,			
	Coronary Heart Disease, Diabetes (Type I			
	& II), Diet, Nutrition & Cancer			
V	Dietary goals & guidelines	8	Students learn about	1, 2
	National Perspectives, Nutritional		the dietary goals &	
	Perspectives of Vegetarian Diets, Social		guidelines	
	Health Issues – Smoking, Alcoholism,			
	Drug Addiction, AIDS and AIDS Control			
	Programs, Food Preservation & Food			
	Additives & Colourants			
Practical	To find out the moisture content from a		Students learn about	
	given food sample by lab oven method		processes involved in	
	To determine the pH of a given sample		food chemistry	
	using pH paper and universal indicator.			
	To test the presence of saccharine in the			
	given sample of beverage.			1, 2, 3, 4
	To identify different pigments present in	30		1, 2, 3, 4
	a given food sample by paper			
	chromatography.			
	To find out the amount of total			
	carbohydrates in a given food sample.			
	To find out the amount of crude fiber in a			
	given food sample.			

## **Text Book:**

1. S. R. Mudambi, M. V. Rajagopal, Fundamentals of Foods, Nutrition and Diet Therapy, 5th Ed, New Age International, 2012

## **Reference Books:**

- 1. B.Srilakshmi, Nutrition Science, New Age International, 2012.
- 2. Handbook of Food and Nutrition, 5th Edition, BAPPCO, 1986

## OTHER LEARNING RESOURCES:

https://nptel.ac.in

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the basic concepts of food & nutrients	1, 5, 7, 8						
2	Describe Food groups	1, 5, 7, 8						
3	Discuss Nutritional needs during life cycle	1, 5, 7, 8						
4	Summarize Prevention and management of deficiencies	1, 5, 7, 8						
5	Explain Dietary goals & guidelines	1, 5, 7, 8						

		SEMESTER-III							
<b>Course Title</b>	COMMUNICAT	ION MASTERY (Commu	nica	tive 1	Engli	sh &	Soft	Skills)	
Course code		Total credits: 2	L	T	P	S	R	O/f	C
		Fotal hours: 60P	0	0	4	0	0	0	2
Pre-requisite	22UMPD111R	Co-requisite				N	il		
	Effective								
	communication								
Programme		Master of Science in C							
Semester		I semester of Second year		_	_				
		ents with the transformatio	n of	sente	ences	and 1	the ap	propri	ate us
	of prepositions.	. 1:11 : 1:00		1.	CV.	1	1		.,.
Course		ting skills in different areas		_					_
Objectives	3. To convey meaning verbal communicat	g by reinforcing, substituting	g Ior,		or		cont	radictii	ng
		on.  erformance boosting activiti	es foi	r nro	faccio	mal o	oal ac	hiovor	nant
CO1		g questions, and idioms con		_	108810	mai g	oar ac	IIICVCI	iiciit.
CO2		ferent sentence types and v							
CO3	<u> </u>	raphs, precis, and profession			nents				
CO4		is, goal setting, and persona					\		
CO5	·	mmunication and body lang			_	_			
Unit		Content	58		- cp ts.				
	. Use of Prepositions								
Module 1-	. Tag questions								
Grammar	. Idioms, Phrases and Cla	uses							
	. Simple, complex, comp	ound sentences							
Module 2-	. Active and Passive Voice	ce							
Grammar	. Direct and Indirect Spee	ech							
	. The Basics of Writing; a	avoid ambiguity and vaguer	ness						
Module 3-	. Paragraph Writing								
Writing	. Precis Writing								
Skills	. Letter Writing								
	. Resume, CV and Cover	Letter							
Module 4-	. SWOT Analysis								
Self-	. Self-Regulation- Goal S	etting							
	. Personal Hygiene								
Skills	WILL NO.								
M - 1-1- 5		mmunication & Body Lang	uage	,					
Module 5- Non- Verbal	Elements of Communication								
	. Types of Body Languag								
on-Sciences	. Importance and Impact								
of Body	· -	Types of Communication through Body Language, Introduction to Haptic, Introduction to Kinesics							
Language	Introduction to Proxemic								
Language		d Don'ts, Doubt Clearing S	essio	n.					
Module 6-	. Importance,	a Ben is, Bener creating a							
Group	. Planning, Elements, and	l Skills assessed:							
Discussion	. Effectively disagreeing,								
(Theory)		and Attaining the Objective	e						
` "		<u> </u>							

- T1. Barrett, Grant. 2016.Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.
- T2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

#### REFERENCE BOOKS

- R1. Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky,2019
- R2. A Textbook for AECC English Communication: Interface, Dr.Kironmoy Chetia and Pranami Bania Breez Mohan Hazarika, January 2019.

#### **OTHER LEARNING RESOURCES:**

- 1. https://youtu.be/x60GHpQ8gJk
- 2. <a href="https://youtu.be/Ke_oSN-BCaY">https://youtu.be/Ke_oSN-BCaY</a>
- 3. <a href="https://youtu.be/TDPDtrLxT-c">https://youtu.be/TDPDtrLxT-c</a>
- 4. <a href="https://www.classcentral.com/report/toefl-preparation/">https://www.classcentral.com/report/toefl-preparation/</a>

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain prepositions, tag questions, and idioms correctly.	3, 8						
2	Discuss and analyze different sentence types and voices.	3, 8						
3	Explain effective paragraphs, precis, and professional documents.	3, 8						
4	Describe SWOT analysis, goal setting, and personal hygiene principles.	3, 8						
5	Illustrate non-verbal communication and body language concepts.	3, 8						

		SEMESTER – I	II							
Course Title	RI	ESEARCH PROJECT I (	SURV	EY/E	XPERI	MENT	S-R1)			
Course code	24MSCH2104R	Total credits: 4	L	L T P S R O/F C						
		Total hours: 8 (P)	0	0	8	0	0	0	4	
Pre-requisite	Nil	Co-requisite				Ni	il			
Programmes		Master of Scien	nce in	Micro	biology	7				
Semester		Fall/III Semester of Sec	econd Year of the Programme							
Course	1. To learn th	ne principles of designing	effect	effective surveys, including question formulation					ulation	
objectives	and sampli	ng techniques.								
	2. To gain ha	nds-on experience in design	gning	and co	nductin	g resea	rch exp	eriments	to test	
	hypotheses	}								
CO1	Formulate research	methodology								
CO2	Prepare research too	ol(s)								
CO3	Apply the knowledg	ge of sampling methods in	sample	e colle	ction.					
CO4	Design experiment using scientific method									
CO5	Investigate the resear	arch Problem								

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Formulate research methodology	1, 2, 4, 5, 6, 8					
2	Prepare research tool(s)	1, 3, 4					
3	Apply the knowledge of sampling methods in sample collection.	1, 2, 3, 4					
4	Design experiment using scientific method	1, 2, 3, 4, 6					
5	Investigate the research Problem	1, 2, 3, 4, 8					

		SEMESTER -	IV							
Course Title	RESEARCH PRO	RESEARCH PROJECT II (RESEARCH DATA ANALYSIS AND DOCUMENTATION-								
			R4)							
Course code	24MSCH2201R	Total credits: 16	L T P S R O/F C							
		Total hours: 32(P)	0	0	32	0	0	0	16	
Pre-requisite	Nil	Nil Co-requisite Nil								
Programmes		Master of Science in Chemistry								
Semester		Spring/IV Semester of S	econd	Year o	f the P	rogran	ıme			
Course	1. To enab	le students to apply exper	imental	l metho	ds to so	lve a g	iven sci	entific ta	sk.	
<b>Objectives</b>	2. To be ab	ole to analyse research dat	a							
	3. To be ab	ole to compile and docume	ent rese	earch da	ata.					
CO1	Learn to tabulate re	esearch data								
CO2	Analyze research o	utcomes								
CO3	Corelate with exiting	Corelate with exiting literature								
CO4	Prepare an effective	Prepare an effective dissertation report								
CO5	Able to communica	ate research outcome								

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Learn to tabulate research data	2, 3, 4, 5, 8					
2	Analyze research outcomes	1, 2, 5					
3	Correlate with exiting literature	2, 5, 8					
4	Prepare an effective dissertation report	4, 5, 6					
5	Able to communicate research outcome	3, 4, 8					

			S	emeste	Semester IV						
Course '	Title		Advanced	l Orgai	nic Syntl	hesis					
Course	code	24MSCH2202R	Total credits: 3		L	T	P	S	R	O/f	С
			Total hours: 457		3	0	0	0	0	0	3
Pre-requ	iisite	Nil	Co-requisite					Ni	il		
Anti-req	uisite	Nil									
Progran	nme		Master of S	Science	in Cher	nistry	,				
Semes	ter				emester						
Cour	se		students about the	concep	t and sig	nifica	nce o	f dyı	namic		
objecti	ves	stereochemistry in o	•								
			the students about t	_	ciples of	orgar	nic sy	nthe	sis, asy	mme	tric
		synthesis and the co	-							_	_
		_	etails about the syr			and 1	eacti	vity	of sing	gle and	d
904		polyheteroatom con									
COI		Explain the concept						1	1	1 .	
CO2	2	Describe the strate	gies for the form	ation c	oi carboi	n-carb	on a	nd (	carbon-	-neter	oatom
000	,	bonds.	4 af a===== .	¢1.	1 '	<u> </u>	n ss4 :		. 41.		
CO3	,	Explain the concep	i of asymmetric s	yntnesi	s and its	s imp	ortan	ce 11	i the s	synthe	esis of
CO4	1	complex molecules.	otagias for multist-	n crostl	ocic.						
COS		Design synthetic stra Explain in detail th				ty of	ging	ام م	nd not	zheta-	natom
	,	containing heterocyc		ure and	i reactivi	iy Of	sing	ic ar	ia pois	meter	oatom
Unit-No.		Containing neterocyc		СН	Learni	ոց Ու	itcor	16	KL	<u> </u>	Ref
I	Dyna	mic stereochemistry		9		ndersta		10	1,2	-	T1
1	1	ospecific and Stereos			stereo			А	1,2		11
		fication of stereose	•			eosele					
		reoselective, enan	•			esis,					
	doubl				Felkir						
		ophilic addition to	_		Anh me						
	I	c ketones– Cram, F				rule					
	Anh	model, Prelog's rul	e, Stereoselective								
		ophilic addition to									
	(Cran	and Felkin-Anh	models). Acyclic								
	stereo	selection: reactions	s at $\alpha$ -and $\beta$ -								
	positi	ons of a chiral center	<u>.                                    </u>							_	
II		netic methods		9	Describ			;	1,2,3		T2,
	1	ation of carbon-carl	_		and exp						R1,
		ving Csp ³ , Csp ² and C	_		syntheti						R2
	(with	*	important name		formati						
		ons); Carbon-carbo	~		carbon						
		ons through enolates	· -		C-C mu	_					
		tes), enamines and	silyl enol ethers.		carbon-	netero	aton	ı			
		ael addition reaction.	- 1 d - 1 · · · · · · · · · · · · · · · · · ·		bonds						
Formation of C-C multiple bonds involving Csp ² and Csp carbon centers (with emphasis											
on important name reactions).											
	Formation of carbon-heteroatom bonds:  New methods for the construction of C-N,										
		C-S and C-X bonds									
		d to the activation of									
III		metric Synthetic M		9	Describ	e and	exnl	ain	1,2, 3	. 4	T2,
	1 x3 y 111	ment symmetre M	CHIUUS		Descrit	o and	CAPI	4111	1,4, 3	, г	149

	Enantioselective synthesis (alkylation, allylation and crotylation reactions), use of chiral reagent; Chiral catalyst and chiral auxiliary; Use of chiral auxiliaries (Evans oxazolidones, Oppolzersultams, Myers amides, Schöllkopf Chiral Auxiliaries). Concepts of asymmetric synthesis: Kinetic resolution (including enzymatic resolution), desymmetrization reactions Asymmetric reactions: Epoxidation (Sharpless, Jacobsen, Shi), Dihydroxylation (Sharpless), Reduction (Noyori, Corey,		asymmetric synthetic methods		R1, R2
TX	Pfaltz)	0	Describe and explain	1 2 2 4	Т2
IV	Retrosynthetic Analysis Basic principles and terminology of retrosynthesis, synthesis of aromatic compounds, one group and two group C-X disconnections, One group C-C and two group C-C disconnections, amine and alkene synthesis, important strategies of retrosynthesis, functional group transposition, important functional group interconversions.	9	Describe and explain retrosynthetic analysis	1,2,3,4	T3, R3
V	Heterocyclic Compounds Structure and reactivity of heterocycles containing one heteroatom (O, N, S) including furan, pyrrole, thiophene, pyridine (Hantzsch pyridine synthesis, Hofmann-Loffler-Freytag reaction), indole (Fischer Synthesis, Bischler Synthesis), quinoline and isoquinoline (Conrad-Limpach reaction, Bischler-Napieralski reaction, Combes reaction, Pictet-Gams synthesis, Skraup/Doebner-von Miller reaction) Heterocyclic rings (with two or more heteroatoms): Pyrazoles, isoxazoles, thiazoles, triazoles and pyrimidines (Claisen synthesis, Fischer synthesis)	9	Describe and explain the chemistry of heterocyclic compounds	1,2	T4

- T1: Eliel, E.L., Wilen, S. H. Stereochemistry of Organic Compounds. Wiley; 2010.
- T2: Carruthers, W. and Coldham, I. Modern methods of Organic Synthesis. Cambridge University Press; 2005.
- T3: Warren, S. Organic Synthesis: The Disconnection Approach, Wiley India Pvt. Ltd.; 2004.
- T4: Li, J.J. Name Reactions in Heterocyclic Chemistry. Wiley; 2006

## REFERENCE BOOKS:

R1. Cary, F. A. and Sundberg, R. I. Advanced Organic Chemistry, Part A and B. 5th edition. Springer; 2009.

**R2**. Smith, M. B. Organic Synthesis. 2nd edition. McGraw Hill Higher Education; 2005.

**R3**: Norman, R.O.C. and Coxon, J.M. Principles of Organic Synthesis. 3rd edition. Chapman & Hall; 2003.

#### **OTHER LEARNING RESOURCES:**

CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the concept of selectivity in organic reactions.	1,2, 5					
2	Describe the strategies for the formation of carbon-carbon and carbon-heteroatom bonds.	1,2,5					
3	Explain the concept of asymmetric synthesis and its importance in the synthesis of complex molecules.	1,2,5					
4	Design synthetic strategies for multistep synthesis.	1,2,5					
5	Explain in detail the synthesis, structure and reactivity of single and polyheteroatom containing heterocyclic compounds.	1,2,5					

SEMESTER-IV															
Course	Title		Natur	al Produ	cts C	Chemist	ry								
Course	code	24MSCH2203R	Total credits: 3	L	T	T P S R O/F				C					
			Total hours: 45T	3	0	0	0	0	0	3					
Pre-requ	ıisite	Nil	Co-requisite				N	il							
Program	nme		Master of	Science	in C	hemistr	y								
Semes	ter	$S_{l}$	pring/IV Semester	of Second	l yea	ar of the	prog	ramm	e						
Cour	se	1.The course ain	ns to provide an a	dvanced	unde	erstandir	ng of	all as	spects of	natural					
Object	ives	products chemistr	•												
			w materials which make the study of natural products a very important												
		subject.													
		3.To teach several classes of natural products, their isolation, extraction, synthesis,													
		biosynthesis etc.													
CO			types of natural prod												
CO2	2		ain the reactions of	•	rates.	. Illustra	te pro	tection	n and						
			rbohydrate synthesis												
CO			penoids, their biosyn				sis.								
CO ₄			narize about steroids												
CO	5		aloids, their physiolo		<u> </u>				mme aspects of natural ts a very important extraction, synthesis, ion and is.  utcome KL hemistry of s, identify of natural ts bohydrates 1,2 enoids and 1,2 eroids and 1,2 eroids and 1,2						
Unit-		Conte	nt	Contac	et	Lea	ırning	g Outc	come	KL					
No.	<u> </u>			Hour		TT 1			• • •	1.0					
I		oduction	• . •	4			-	1,2							
		ural products chem				_		•							
		tment. Primary and	secondary	different types of natural products											
		abolites.		10		т	_		1 .	1.0					
II		bohydrates		10		Learn	1,2								
	_	n chain and ring st													
		osaccharides, reac													
		mericcentre, reactions, eyelic acetals,													
	_	vation, chemical di													
		nation, enzymatic d													
		nation, introductory													
		obiology,	Chemical												
		stration of protection	on and												
		otection in carbohy													
III		penoids	, <u>, , , , , , , , , , , , , , , , , , </u>	10		Learn a	about	terpen	oids and	1,2					
		oduction to terpeno	ids, isoprene and					_							
		genetic isoprene rul													
	Bios	synthesis of mono	and												
	sesq	uiterpenoids, discu	ssion on												
	cary	ophylene, longifol	ene, santonin,												
abietic acid, and taxol, total synthesis of															
		enes (caryophylene													
IV		oids and Caroten		11		Learn				1,2					
		oduction to steroids					carot	enoids	3						
		s, sex hormones, ca	ardiac glycosides												
		corticosteroids.													
		eral introduction	, and the second												
		-	beta- and gamma-												
	carotenes, vitamin-A.														

V	Alkaloids	10	Learn about alkaloids and	1,2
	Introduction to alkaloids, physiological		their total synthesis	
	activity of alkaloids, Discussion on			
	morphine and reserpine and their total			
	synthesis			

- T1: Bhat, S. V., Nagasampagi, B.A., Sivakumar, M. Chemistry of natural products. Springer Narosa; 2005.
- T2: Kalsi, P. S.andJagtap,S. Pharmaceutical, medicinal and natural products chemistry. Alpha Science International Ltd.; 2013.
- T3: Finar, I. L. Organic Chemistry. Vol-2, Pearson; 2009.
- T4: Davis, B. G. and Fairbanks, A. J. Carbohydrate Chemistry. Oxford University Press; 2002.
- T5: Sell, C. A Fragrant Introduction to Terpenoid Chemistry. RSC; 2003.

## **REFERENCE BOOKS:**

- R1: Krishnaswami, N. R. Chemistry of natural products-A Unified Approach. University Press; 1999.
- R2: Talapatra, S. K. and Talapatra, B. Chemistry of Plant Natural Products. Springer; 2015.

#### **OTHER LEARNING RESOURCES:**

https://nptel.ac.in

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Identify different types of natural products.	1, 2, 5							
2	Describe and explain the reactions of carbohydrates. Illustrate protection and deprotection in carbohydrate synthesis.	1, 2, 5							
3	Discuss about terpenoids, their biosynthesis and total synthesis.	1, 2, 5							
4	Explain and summarize about steroids and carotenoids	1, 2, 5							
5	Discuss about alkaloids, their physiological activity and total synthesis.	1, 2, 5							

	SEMESTER										
Course Tit	tle Organometallic	Chemistry	and (	Cataly	sis						
Course co	de 24MSCH2204R Total credits: 3	L	T	P	S	R	O/F	C			
	Total hours: 45T	3	0	0	0	0	0	3			
Pre-requis					N	il					
Programn											
Semester	1 8				gran	me					
Course	1. To study the concept of 18 electron- system	_									
Objective		-	•	exes.							
	3. To understand the bonding of metal carbonyl complexes.										
	4. To study the concept and reactions associated with different organometallic compounds.										
	5. To study the basics of different metal cluster	ers.									
CO1	Explain the 18 electron system										
CO2	Describethe structure and bonding of various alk	-									
CO ₃	Describe the bonding of metal carbonyl, nitrosy	_		l apply	the co	oncept	to identify	the			
	stretching strength of the various types of carbon	• •	ınds.								
CO4	Describe the different metal cluster complexes										
CO5	Analyse and apply the concepts of different org							_			
Unit-No.	Content	Contact Hour	t	Le	arnin	g Outc	come	KL			
I	18 electron system	6		Unde	rstand	the co	ncent	1,2			
1	18 electron system, molecular orbital theory,					on syst	_	1,2			
	Isolobal analogy.					-					
	isoroom manogy.			molecular orbital theory in organometallics.							
II	Metal alkyl, arenes, metallocene complexes	10		Describeandexplain the							
	Structure, bonding and synthesis and reactions	10				-	ling of	1,2			
	of metal complexes with alkyls, aryls,					lexes.	8				
	alkenes, alkynes, allyls, carbenes, carbide			J	1						
	alkyl complexes, arenecomplexes,Πallyl										
	complexes, metallocenes and bent										
	metallocenes ,double and multidecker										
	sandwich complexes.										
III	Metal carbonyl and nitrosyl complexes	10		Und	erstan	d the		1,2			
111	Synthesis, structure, bonding and reactivity of			structure, bonding and							
	mono and polynuclear metal carbonyls.					of meta	-				
	Substituted metal carbonyls. Vibrational spectra				•	omple					
	of metal carbonyls, nitrosyls, tertiary				,	•					
	phosphines, metallation reactions. Substitution,										
	Oxidative addition, Reductive elimination,										
	Insertion reactions										
IV	Metal clusters:	9		Und	erstan	d the b	onding	1,2			
	Synthesis and bonding in metal clusters. Low			in di	fferen	t metal					
	and high nuclearity metal carbonyl and metal			clust	ers.						
	halide clusters, Metal-metal quadruple bonding										
	in Re ₂ Cl ₈ ²⁻ ,Isolobal analogy in organometallic										
	and cluster compounds.										
V	Catalysis:	10	10 Understand the differ					1,2			
	Introduction and definition, Catalysis -				•	eaction	S				
	hydrogenation, hydroformylation, Monsanto				ciated						
	process, Wacker process, alkenepolymerization,			orga	nome	tallic co	omplexes				
	olefin metathesis, Fischer-Tropsch carbon chain										
	growth, use of ZSM-5 for organic										
	transformation, Suzuki coupling reaction.										

T1. J. E. Huheey, E. A. Keiter and R. L. Keiter; Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed. Pearson Education, 2006.

## **REFERENCE BOOKS:**

R1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong; Shriver & Atkins, Inorganic Chemistry, 5th Ed. Oxford University Press, 2010.

R2. G. L. Miessler, D Tarr; Inorganic Chemistry. 3rd Ed., Pearson Education, 2004.

R3. A.K. Das , M. Das, Fundamental Concepts of Inorganic Chemistry, Vols. 1-7, CBS Publishers and Distributors, 2015

#### **OTHER LEARNING RESOURCES:**

https://nptel.ac.in

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the 18 electron system	1, 2, 5						
2	Describethe structure and bonding of various alkyl, arene complexes.	1, 2, 5						
3	Describe the bonding of metal carbonyl, nitrosyl complexes and apply the concept to identify the stretching strength of the various types of carbonyl compounds.	1, 2, 5						
4	Describe the different metal cluster complexes.	1, 2, 5						
5	Analyse and apply the concepts of different organometallic catalytic reactions	1, 2, 5						

			SEMEST	ER-IV							
Course	Title		Inorganic	Reaction	Me	chanisr	n and	Kine	tics		
Course	code	24MSCH2205R	Total credits: 3	L	T	P	S	R	(	O/F	C
			Total hours: 45T	3	0	0	0	0		0	3
Pre-requisite		Nil	Co-requisite			1		Nil			1
Programme			Master	of Scienc	e in	Chemi	stry				
Semes			Spring/IV Semester	of Secon	d ye	ar of th	ie pro	gram	me		
Cour	se	1. To gain knowledg	ge on inert and labile co								
Object	ives	2. To make the stude	ents understand the bas	sic concep	t an	d factor	s resp	onsib	e for s	stabilit	y of
· ·		complexes.									
		3. To understand the different inorganic reaction mechanisms, the kinetics, reaction and									
		mechanism of differ	ent coordination comp	lexes.							
CO	1	Define inert and lab	ile complexes and expl	lain their	kine	tic as w	ell as	therm	odyna	mic	
		stability									
CO2	2		concept as well as fac								
CO	3	Analyze the differen	nt inorganic reaction m	nechanism	ıs-li	gand rep	placer	nent, s	ubstiti	ution	
		reactions									
CO ₂	ļ	1	cs, reaction mechanism						exes		
CO:	5	Summarize the diffe	rent redox mechanism	of co-ord	linat	ion con	nplexe	es			
Unit-		Conte	nt	Contac	ntact Learning Outc			tcome		KL	
No.				Hour 7							
I	1	Thermodynamic and Kinetic stability:				Gain kn		_	the		1,2
	1	and labile complexe	s, Factors affecting			differen					
	on la	bility of a complex			abile ar		rt				
				10	C	complex					
II	1	Stability and stability constant:				Under					1,2
	1	llity constant, Factors			thermo	-		_			
	1	lity of complexes, Co			related	l to st	ability	consta	ant.		
	1	tant with thermodyna									
	1	etermination of stabil									
***		Bjerrum's methods.	10	-	TT 1	. 1	.1 11	20 .		1.2.2	
III		ction mechanisms an	10		Under					1,2,3	
		hanism of ligand repl				_			action		
		ors affecting the rate				mecha	nısms	sms.			
		ion, Substitution read									
	_	olexes. Solvolysis and									
	1	ion, acid and base hy mization and Isomer									
IV				8		Under	stand	tha tra	10.0		1,2
1 V	1	ction, Kinetics and r rdination Chemistry	0		effect					1,2	
			quare planar reaction,			detern					
		I),Pt(II),Pd(II)] comp				inorga					
	_ `	ts applications.			morga		mpou	nus.			
V			actions.	10		Under	stand	the di	ferent	-	1 2 3
*				10							1,2,3
						TOUGA		w11101111	••		
		=	=								
V	Electredox react	hanism of Redox reaction transfer reaction is reaction, Inner spherion. Nature of bridging the rates of direction.	, Mechanism of ere and Outer sphere ng ligand, Factors	10		Under redox					1,2,3

T1. G. L. Miessler, D Tarr; Inorganic Chemistry. 3rd Ed., Pearson Education, 2004

**T2**. P.W. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong; Shriver & Atkins, Inorganic Chemistry, 5th Ed. Oxford University Press, 2010.

#### **REFERENCEBOOKS:**

**R1**. J. E. Huheey, E. A. Keiter and R. L. Keiter; Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed. Pearson Education, 2006.

**R2**. A.K. Das , M. Das, Fundamental Concepts of Inorganic Chemistry, Vols. 1-7, CBS Publishers and Distributors, 2015

#### **OTHER LEARNING RESOURCES:**

https://nptel.ac.in

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Define inert and labile complexes and explain their kinetic as well as thermodynamic stability	1, 2, 5							
2	Summarize the basic concept as well as factors responsible for stability of complexes	1, 2, 5							
3	Analyze the different inorganic reaction mechanisms-ligand replacement, substitution reactions	1, 2, 5							
4	Assess on the kinetics, reaction mechanism of different coordination complexes	1, 2, 5							
5	Summarize the different redox mechanism of co-ordination complexes	1, 2, 5							



## **Assam down town University**

## Curriculum and Syllabus

## **Master of Science in Mathematics**

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM Version: 1.0

**FACULTY OF SCIENCE** 

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the programme

and to be eligible for the degree. This volume also includes the prescribed literature, study

materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

The same

Chairperson, Board of Studies

Downey

Member Secretary, Academic Council

#### Vision

To become a Globally Recognized University from North Eastern Region of India, dedicated to the Holistic Development of Students and Making Society Better

#### Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

#### **Programme Overview**

M.Sc. Mathematics offers a wide range of courses covering various pure and applied areas of mathematical science. The students develop a disciplined thought process, logical articulation and problem-solving attitude through different thrust areas of this branch of science. It is designed to strengthen students mathematical background by in-depth knowledge of mathematical concepts. An M.Sc. in Mathematics gives students who want to work in science, engineering or computing a solid core education. The programme also includes various aspects of knowledge like- universal ethics, overall development and employability scopes in research, industry and teaching sectors. The course duration is a period of 2 years.

#### I. Specific Features of the Curriculum

- Interactive learning
- Constructivist approach to learn
- Project based learning

The curriculum provides ability enhancement, skill enhancement and value-added courses along with the core papers.

#### II. Eligibility Criteria:

B.Sc. with 45% marks or equivalent CGPA in Mathematics. (5 % relaxation for SC/ST, EWS, and Specially abled candidates).

#### **III.** Program Educational Objectives (PEOs):

- **PEO-1:** Graduates will be able to pursue respectable employment in the domain of teaching and research and banking sectors.
- **PEO-2:** Graduates will contribute to the application, advancement, and transmission of knowledge in interdisciplinary fields of engineering and technology.
- **PEO-3:** As an effective team member, graduates will demonstrate great professional skills, communication abilities, and ethical traits in a globally competitive environment.

#### IV. Program Specific Outcomes (PSOs):

- **PSO1:** Capable of identifying problems, design strategy for solving them, and analyse effective solution(s) applying mathematical principles and associated tools.
- **PSO2:** Capable of excelling mathematical modelling, designing and developing algorithms including application tools.
- **PSO3:** Comprehend and apply mathematical knowledge and skill, apply them to resolve problems associated with socio-scientific structures for societal upliftment.

#### V. Program Outcome (PO):

- **PO1: Scientific Knowledge:** Ability towards logical reasoning with articulation of mathematical aspects associated with various scientific phenomena.
- **PO2**: **Analytical skill**: Ability to analyse and interpret problems relevant to technologies, Socio economics etc.
- **PO3: Problem solving skills**: Ability to apply theoretical concept to solve various problems.
- **PO4**: **Proficiency:** To encourage towards proficiency in mathematical software like- Math type, Mathematical, Latex etc.
- PO5: Communication skill: Development of communication skill to communicate

scientific and technological thoughts with the peers and society.

**PO6: Professional ethics**: Enrichment of knowledge towards professional ethics.

**PO7: Research**: Temperament to take up research as a career to develop new knowledge in thrust areas.

**PO8: Social Responsibility**: Sense of responsibility to do utmost possible for development of Society by educating mass for numeracy skill, solving problems, removing superstitions and there by contribution to nation building as a whole.

#### VI. Total Credits to be Earned: 89

#### VII. Career Prospects:

- Capabilities for a career in wide range of potential job prospects, including from Mathematician, Statistician, Teacher/Professor, Software Developer/Engineer.
- Demonstrate concepts and research approaches for a future profession in mathematics and develop their scientific interest.
- Insurance and Banking sectors afford a plethora of job opportunities after M.Sc. Both the private and public sectors are actively in the fray. The Banking and Insurance sectors provide various Career options after M.Sc. Mathematics as M.Sc. Mathematics degree holders have multiple avenues to join big firms as Data analysts, Estimators or as Data Scientists.
- For those students who have a knack for solving complex numerals, there are bright Career options after M.Sc. Mathematics to assume the role of a Numerical Analyst.
- For those students who have a knack for solving complex numerals, there are bright Career options after M.Sc. Mathematics to assume the role of a Numerical Analyst.

#### **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers**:

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Level Questions /verbs for test						
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when,						
1		where, etc.						
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.						
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify						
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.						
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.						
6	Create	Design, Formulate, Modify, Develop, integrate, etc.						

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Sl noQuestion patternTotal marks1MCQs (10 Questions)1022 Marks questions (10 Questions)2034 Marks questions (5 Questions)20410 Marks questions (1 Question)10

Table 1: Question paper pattern for End semester examination

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

#### VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new

answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus, CP = GP x CR

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

**Grade Points** Letter Grade **Description** 0 10 Outstanding 9 Excellent A+Very Good Α 8 B+Good В 6 Above Average  $\mathbf{C}$ 5 Average P 4 Pass F **Fail** 0 0 Abs Absent Unfair Means **UFM** 0

**Table 2: Letter Grades and Grade Points** 

#### iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses

graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words,taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
(1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### **D.** Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

#### (Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favour because this strategy for teaching is seen to favor passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watchvideo or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned problem. The same has to be done in group so that the students discuss among

themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

#### The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of	
teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

#### Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file

#### **Breakdown of Credits**

Sl. No	Catagory		Total number of			
51. 110	Category		Credits			
		Skill Enhancement Course (SEC)	2			
		Ability Enhancement Course(AEC)	4			
1	University Core(UC)	Field Training	-			
1	University Core(OC)	Discipline Specific Elective (DSE)	-			
		Value Added Course (VAC)	6			
		Co and extra-Curricular	2			
2	University Elective (UE)	Multidisciplinary Course (MDC)	2			
2	Offiversity Elective (OE)	Value Added Course (VAC)	-			
		Discipline Specific Core(DSC)	27			
3	Program Core(PC)	Field Training	2			
3	riogram Core(rC)	Research /Industry Internship	20			
		Summer Internship	4			
4	Program Elective (PE)	Discipline Specific Elective (DSE)	18			
4	Program Elective (PE)	Value Added Course (VAC)	-			
5	Faculty Care(FC)	Skill Enhancement Course (SEC)	2			
3	Faculty Core(FC)	Ability Enhancement Course(AEC)	-			
	Total					

### **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	83	93.26%
2	Humanities and Social Sciences	6	6.74%
	Total	89	100%

#### SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code	Course Title	Course		En	gag	gen	nen	t		Max			
	N.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSMT1101R	Differential Equation	DSC Major	3	1	0	0	0	0	4	40	60	0	100
	2	24MSMT1102R	Abstract Algebra	DSC Minor	3	1	0	0	0	0	4	40	60	0	100
ester	3	24MSMT1103R	Real Analysis	DSC Minor	3	1	0	0	0	0	4	40	60	0	100
Sem	4	24UMNM1102R	Numerical Methods for Interdisciplinary Sciences	MDC	2	0	0	0	0	0	2	40	60	0	100
	5	24UMPD1101R	Effective Communication(PDP)	AEC	0	0	4	0	0	0	2	50	0	50	100
	6	24UMEC1101	Extra-curricular  Extra-curricular  Curricular		0	0	0	0	0	0	1	0	0	100	100
		То								17				600	
	S.	Course Code	Course Title	Course	Engagement					t		Max			
	No.	Course Code	Course Title	Category	L	Т	P	S	R	0	C	IA*	for SEE*	PE*	Total
•	1.	24MSMT1201R	Partial Differential Equation	DSC Major	3	1	0	0	0	0	4	40	60	0	100
Semester II Semester I	2	24MSMT1202R	Linear Algebra	DSC Major	3	1	0	0	0	0	4	40	60	0	100
	3	24MSMT1203R	Complex Analysis	DSC Major	3	1	0	0	0	0	4	40	60	0	100
ı.	4	24UMPD1201R	Advanced Communication	SEC	0	0	4	0	0	0	2	0	0	100	100
mester	5	24MSMT1204R	Postgraduate Practice Teaching	SEC	2	0	0	0	0	0	1	0	0	100	100
	6	24MSMT1205R	Research methodology and Statistical Analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using MS Excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSMT1206R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100
	9	24UMCC1201	Co-curricular	Co and extra Curricular	0	0	0	0	0	0	1	0	0	100	100
		То	tal								22				1000

	S. N.	Course Code	Course Title	Course		En	gaş	gen	nen	t					
	11.	Course Coue	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSMT2101R	Computer Programming C+	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	2	24UMPD2101R	(PDP)	(PDP) AEC (		0	4	0	0	0	2	0	0	100	100
	3	24MSMT2102R	Internship	Internship	0	0	0	0	0	32	4	0	0	100	100
	4	24MSMT2103R	Field Visit	Field Training	0	0	`	0	0	8	1	0	0	100	100
Semester III	5	24MSMT2104R	Research Project I	Research/ Industry Internship	2	1	0	4	0	0	4	0	100	0	100
Š	6	6 24MSMT2105R Indian Knowledge System		VAC	0	0	0	0	0	0	2	0	0	100	100
			tive (Any thi	ee	sut	ojeo	ets 1	to t	e se	elect					
	7	24MSMT2106R	Topology	DSE	4	0	0	0	0	0	4	40	60	0	100
	8	24MSMT2107R	Mechanics and Tensor	DSE	4	0	0	0	0	0	4	40	60	0	100
	9	24MSMT2108R	Functional analysis	DSE	4	0	0	0	0	0	4	40	60	0	100
	10	24MSMT2109R	Number Theory	DSE	4	0	0	0	0	0	4	40	60	0	100
	11	24MSMT2110R	Fluid dynamics	DSE	4	0	0	0	0	0	4	40	60	0	100
		Т	otal								28				1000
	S. No.	Course Code	Course Title	Course	Engagement					t	Maximum Marks for				
	110.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
VI.	1.	24MSMT2201R	Research Project II	Research/ Industry Internship	8	4	0	12	6	0	16	0	100	0	100
ste			Discipline specific Elec	tive (Any tw	70 S	ub	jec	ts t	o b	e sel	lecte	d)			ı
Semester IV	2.	24MSMT2202R	Continuum Mechanics and Hydrodynamics	DSE	3	0	0	0	0	0	3	40	60	0	100
	3.	24MSMT2203R	Mathematical Methods	DSE	3	0	0	0	0	0	3	40	60	0	100
	4.	24MSMT2204R	Operation Research	DSE	3	0	0	0	0	0	3	40	60	0	100
	5.	24MSMT2205R	Fuzzy Sets & Systems	DSE	3	0	0	0	0	0	3	40	60	0	100
		T								22				300	
		Gran	d Total								89				2900

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEMESTER	2 – I											
Course '	Title		Differe	ential	Equa	tion									
Course	code	24MSMT1101R	Total credits: 4		L	T	P	S	R	O/F	C				
		222 22	Total hours: 60'		3	1	0	0	0	0	4				
Pre-requ	ıisite	ODE of first	Co-requisite	:				Ni	l						
		order and second													
		order and their General													
Progran	nma	Solutions  Master of Science in Mathematics													
Semes		1	Fall/ I semester of					amme	<b>.</b>						
Cour			nd know the method							1 Equatio	ons in				
Objecti		explicit form		01 11		, bora	orom or	Diffe	7 0 11 0 1 0	1 Equation	7115 111				
		•	and able to apply	wheth	er a	Diffe	rential	Equ	ation	has a u	nique				
		solution or no						1			•				
		3. To explain va	arious series solution	n of 2 ⁿ	d orde	r Dif	ferenti	al Equ	uations	S.					
		4. To explain in	itial and boundary v	alue p	roble	m.		_							
		, ,	en values and Eigen	funct	ions o	f Stur	m Lio	ville	systen	ıs, stabil	ity				
		of systems of ODEs.													
COI		Describe Differential Equation and its classification according to linearity and order.													
CO2		Prove the existence theorem for a system of 1 st order Differential Equation.													
CO3	<b>,</b>	Identify the series solution of 2 nd order Differential Equation with particular reference to Legendre, Bessel, Hermite and Gauss.													
CO4	ı	<b>X</b>			CC	4: -1 T	· · · · · ·		11		11				
CO4	•	Verify the existence boundary value prob	_	OI DI	Heren	tial E	equatio	ons in	IVOIV11	ng initia	land				
CO5		Identify the concep		tem of	ODE	l ac v	7011 ac	Fige	n volu	es and E	ligen				
	•	functions of Sturm l		icili Oi	ODL	as v	ven as	Lige	ii vaiu	es and 1	ngen				
Unit-		Content		Con	ntact Learning Outcome K										
No.				Но		Dear ming outcome									
I	Linea	r differential equati	on of 2 nd order,	1:	5	Able	2	to	unc	derstand	1				
	Gener	al solution of homo	ogenous and non-			Diff	erentia	ıl Equ	ıation	and its	2				
	homo	genous equations, va	riable coefficients,			class	sificati	on a	accord	ing to	3				
	I	ion of parameters.					arity a								
II		ence theorems of 1	•	10	0	Able			lerstar		1				
		nents of existence					tence		rem	for a	2				
		n of 1 st order equation				syste		of	1 st	order	3				
TTT		ential equations, Wro		4.	0		erentia			1 4 !	1				
III		solution for ODE, so		10	U	Able of				solution ferential	1				
		ary point, types of sin ngular point.	guiarity, solution				2 dation	oraer witl		articular	2 3				
	ai a SI	nguiai point.				•	ence	to	•	egendre,					
	Metho	od of series soluti	on of 2 nd order				sel, He			_					
		particular reference				,									
		gendre, Bessel, Hermi													
IV		ence and uniqueness		10	Able to find the existence										
	I	value problems fo				and	1	uniqu	eness	of	3				
	Singu	lar solution of 1st order	er ODE.			Diff	erentia	ıl	Ec	quations					
							lving		nitial	and					
							ndary		_						
V		ral theory of homo	_	1:	5	Disc	uss l	Eigen	valu	es and	1				
1	homo	genous linear 2 nd ord	ler ODE's, Sturm-								2				

Liouville boundary value problem. Se	f Eigen functions of Sturm-	3
adjoint boundary problems associated with	Liouville systems, and the	
2 nd order linear differential equation.	solutions of initial and	
	boundary value problems.	

#### **TEXTBOOKS:**

- T1. Ross, S. L. (1984), Differential Equations, Wiley India.
- T2. Coddington, E. A. (2001), An Introduction to Ordinary Differential Equations, PHI.

#### **REFERENCEBOOKS:**

- **R1**. Boyce, W. E., DiPrima, R. C. (2009), Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India
- R2. Piaggio, E. T. H. (1985), Differential Equations, CBS Publishers and Distributors.

#### OTHERLEARNINGRESOURCES:

- 1. http://mathforum.org.
- 2. <a href="http://ocw.mit.edu/ocwweb/Mathematics">http://ocw.mit.edu/ocwweb/Mathematics</a>.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe Differential Equation and its classification according to linearity and order.	1,3
2	Prove the existence theorem for a system of 1 st order Differential Equation.	1, 3, 4, 7
3	Identify the series solution of 2 nd order Differential Equation with particular reference to Legendre, Bessel, Hermite and Gauss.	1, 2, 3, 4, 8
4	Verify the existence and uniqueness of Differential Equations involving initialand boundary value problems.	1, 2, 3, 8
5	Identify the concept of stability of system of ODE as well as Eigen values and Eigen functions of Sturm Lioville systems.	1, 3, 4, 8

	SEMESTER – I													
Cours	se Title			Abst	ract Algebra									
Cours	se Code	24MSMT1102R	Total cre	dits: 4		L	T	P	S	R	O/F	C		
			Total hou			3	1	0	0	0	0	4		
	equisite	Nil			-requisite Nil									
	ammes	Master of Science in Mathematics												
	iester	Fall/I Semester of First Year of the Program												
	urse	1. To know some special groups, subgroups, normal subgroup and their properties.												
objec	ctives:	<ol> <li>To study the class equation of a group and its related results.</li> <li>To study the series of groups. Jordan Holder theorem and its applications.</li> </ol>												
		*							catio	ns.				
		4. To know the ring	~	_	-									
		5. To study three in	-		-		, the	Princ	eipal	ıdea	l Dom	aın,		
	01	Euclidean domai		_			*		1 -	. 1	1:			
	01	Define group, subgr								ea re	esults.			
	O2	Define class equation				neir	app	licatio	ons.					
	03	,	Define series of groups and its related results.											
	04	Describe ring structure along with properties and its related results.  Describe the classes of Ring structures, viz., the Principal ideal Domain, Euclidean												
	O5		_			ncıp	ai ic	ieai i	Joma	ıın,	Euciio	iean		
Unit-		domain and the unic	que factoriz			. •	0	L			1/2	Т		
No.		Content		СН	Leari	nng	Ou	come	2		K	L		
I	Introduct	ion to Groups, Dihed	ral groun	15	Describe the C	1	,2							
•		on groups, Quaternic		10	properties, var		,_							
	-	omomorphism, Direc			and the related results. Group									
	_	os, Fundamental the	-		homomorphisi				_	ct of	,			
		lian groups.			groups.			•						
II	Group ac	tions, Class equation	of finite	10	Describe the C	irou	p the	oretio	e not	ions	1,	,2		
	groups,	Sylow's theore	m and		of class equation and the related									
	application	on.			results									
III	Series of	f groups, Normal	and sub-	10	Describe the se	eries	s if g	roups	. Jor	dan	1,	,2		
		series, composition	· ·		Holder theorem	n ar	nd its	appli	icatio	ns				
	solvable g	groups, Jordan Holde	r theorem											
	and appli	cations.												
IV	Introduct	ion to Rings, Homor	morphism	10	Describe the ri	1,2	2,3							
	of ring,	, Ideal and fact	tor ring,		properties and related results.									
	Polynomi	ial rings.												
V	Irreducib	ility of ring, ED, Pl	ID, UFD,	15	Discuss three	impo	ortan	t clas	ses o	f	1,2	2,3,		
	Field exte	ensions.			Ring structure	s, vi	z., tł	ne Pri	ncipa	1		4		
					ideal Domain,	Euc	lide	an do	main	and				
1					the unique fact	toriz	zatio	n don	nain.					

#### **TEXTBOOKS**:

- T1. Herstein, I. N. (1975). Topics in Algebra Wiley. Eastern Limited.
- T2.Dummit, D. S., Foote, R. M. (2004). Abstract Algebra. Hoboken: Wiley.+
- T3. Gallian, J. A.(2013). Contemporary Abstract Algebra, New Age International.

#### **REFERENCE BOOKS:**

- R1. Hungerford, T. W., Algebra. (1974). Springer-Verlag. New York.
- R2. Bhattacharya, P. B., Jain, S. K., Nagpaul, S. R. (1994). Basic Abstract Algebra. Cambridge University Press.

#### OTHER LEARNING RESOURCES:

1. www.algebra.com

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Define group, subgroups, normal subgroups including properties and related results.	1,3
2	Define class equation of group, Sylow's theorems and their applications.	1,4
3	Define series of groups and its related results.	1,3,4
4	Describe ring structure along with properties and its related results.	1, 2, 7
5	Describe the classes of Ring structures, viz., the Principal ideal Domain, Euclidean domain and the unique factorization domain.	1, 8.

			SEMESTER	R – I										
Course	Title		Re	eal Ana	lysis									
Course	code	24MSMT1103R		L	T	P	S	R	O/F	C				
			Total hours: 60T	3	1	0	0	0	0	4				
Pre-requ	uisite	Convergence of	Co-requisite				Ni	il						
		sequence and												
		series	series											
Prograi				cience in Mathematics										
Semes		1 To 22 do 2004 o 20	Fall/ I semester of t						. D					
Cour		1	l Real Number System ntify its special metric			erties.	Also C	iescrib	e K as a	metric				
Object	ives	_	e properties of advance			tion a	nd Inte	aratio	n of real	valued				
		1	ne or multiple variabl		CICIIIIa	tion ai	iu iiic	granoi	ii oi icai	varucu				
			the difference betwe		/eroen	ce and	unifor	rm con	vergence	e.				
			nature of convergence		_				, organic					
			concept of R-S integra						emann ar	ıd R-S				
		integral.	1 &											
CO	1	_	mber System, its prop	perties i	ncludii	ng met	tric spa	ace.						
CO	2	Analyze the pro-	perties of advanced	differen	ntiatio	n and	Integ	ration	of real	valued				
		functions in one of	or multiple variables.											
CO	3	Explore the difference between convergence and uniform convergence including the												
		methods of convergence, absolute convergence in terms of sequence of functions.												
CO	4	Describe the nature of convergence in terms of series of function.  Describe the concept of R-S integral and the difference between Riemann and R-S												
CO	5		cept of R-S integral	and the	e diffe	rence	betwe	en Rie	emann a	nd R-S				
		integral.		I						1				
Unit-		Conte	nt	СН		Lear	ning (	Outcon	ne	KL				
No.	Dualia	minarias Cayatah	le and uncountable		Able	- to	na da	rstand	Real					
I			stem, Archimedean		Nun		Syste		nd its					
	prope	•		15			•		be R as	1,2				
		•	n continuity, Metric	13	1 ^ ^					1,2				
	space	•	· · · · · · · · · · · · · · · · · · ·		a metric space and identify its special metric properties.									
		-	eorem, Heine-Borel		_F		F-	- F						
	theor		,											
II	Func	tion of several va	riables, Continuity,		Able	e to an	alyze	the pro	perties					
	Direc	tional derivatives	, total derivatives,		of	advan	ced o	lifferei	ntiation					
	Jacob	oian matrix, Mean	value theorem for	10	and	Integr	ation o	of real	valued	1,2				
		rentiable function	n, maxima and				in one	e or n	nultiple					
	minir					ables.								
III	_ ^		ns, Pointwise and		Able			lerstan						
	unifo	$\mathcal{C}$		10		erence			etween	1,2				
		~	vergence, functions			ergen		nd u	ıniform					
TX 7		unded variation.				ergen		.1	, C					
IV			t of convergence in	10					ture of	1.2				
	terms	of series of function	OHS.	10		ergen	ce ir inction		ms of	1,2				
V	Riam	ann-Stieltjes inte	egrals, The R-S		Able			ı. erstand	l R-S					
		ami-buciyes ilit	- Z1010, 1110 IV-D	1	AUK	. 10	unu	cistant	1 1/-12	1				
		-	-		inte	oral :								
	integ	ral as a limit of si	um, Classes of R-S	15	_	-			_	1.2				
	integr integr	ral as a limit of sural functions,	-	15	diffe	erence		een R	ng the iemann	1,2				

#### **TEXT BOOKS:**

**T1**. Upadhyay. Biophysical chemistry: principle and technique. 12th edition. Himalaya Publishing House Pvt. Ltd; 2017.

#### **REFERENCE BOOKS:**

- R1. Kakkar. Atomic and Molecular Spectroscopy. 1st edition. Cambridge English; 2017.
- R2. Evans. Handbook of Chromatography. 2nd Edition, Willford Press; 2019.
- R3. Holme and Peck. Analytical biochemistry. 3rd edition. Longman, 1983.

#### OTHER LEARNING RESOURCES:

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromatography

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Discuss Chromatography techniques including history, classification, principles, operation, analysis and application.	1, 3, 4						
2	Define Centrifugation techniques, classification, principles, operation and its application.	1,3						
3	Explain and investigate Electrophoresis, its categorization, underlying principle, operational methods, pH meter functionality, dialysis, and blotting methodologies.	1,3, 4						
4	Discuss radioisotope dating principles, including detection, measurement, isotopes, radiation, units and decay.	1, 3, 4						
5	Develop the comprehensive understanding of principles, and practical application skills in various spectroscopic methods for scientific analysis.	1, 3, 4						

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and					
	1,2				

#### **TEXT BOOKS:**

- T1. Kincaid, D., Cheney, W. (2002). Numerical Analysis: Mathematics of Scientific Computing. AMS.
- T2. Atkinson, K., Han, W. (2003). Elementary Numerical Analysis, John Wiley & Sons

#### **REFERENCE BOOKS:**

**R1.** Conte, S.D. (1980). Elementary Numerical Analysis: Algorithmic approach. Tata McGraw Hills **R2.**Madhumangal, P. (2009). Numerical Analysis for Scientist and Engineers. Narosa Pub. House.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the basic concepts of statistics, finite difference, errors and operators.	1,4
2	Master the solving skills of system of linear equations using numerical methods.	1,4
3	Utilize integral methods to solve the problems related to science and engineering.	1,4
4	Explore various issues in numerical techniques such as convergence and stability.	1,4
5	Analyze graphical representation of functions using general least square method.	1, 4, 7.

		SEMESTER	1 – I									
Course Title		EFFECTIVE	COM	MUNI	CATIO	N						
Course code	24UMPD1101R	<b>Total credits: 2</b>	L	T	P	S	R	O/F	C			
		Total hours: 60P	0	0	4	0	0	0	2			
Pre-requisite	Nil Co-requisite Nil											
Programmes	Master of Science in Biotechnology											
Semester	Fall/I Semester of First Year of the Programme											
Course	1. To introduce the types of sentences and their significance.											
objectives	2. To strengthen the students' vocabulary to enhance their speaking and writing skills.											
		rize the students with	h the	impor	tance	of dre	ss cod	es in va	rious			
	organizations.											
		ethe3P's (Planning, price		•		·		•				
		ight into English pronur			nto cent	tral cor	ncepts in	n phonetic	s.			
CO1		y the different types of										
		e skills of reading and s						ation.				
CO3		uette sessions will boos				d mora	ıls.					
CO4		effective and efficient u										
CO5		cept of Phonetics an	d its	impor	tance	will i	mprove	the lea	rners			
	'pronunciation											
MODULES	Module 1- Gramı											
	•	nterrogative and Asse					•		ertive			
		of Tenses, Common Erro	ors, Sy	nonym	s, Anto	nyms,	Homon	yms				
	Module 2- Readir	_										
	_	ective Reading, gathering	ng idea	as and	inform	ation f	rom a t	ext The S	Q3R			
	Technique Interpre											
	Module 3-Listeni	U										
	_	? The Process of List	_				-		_			
		n Listening and Hearing	, Purp	ose and	l Impoi	tance of	of Effec	tive Liste	ning,			
	How to Improve L	-										
	Module 4- Conflic	Ü										
		of Conflict Managemen	t, Effe	ects of	Confli	et Man	agemer	nt, Method	ds to			
	deal with Conflicts	` • /										
		Management Skills		1 7		c	3.6					
		me Management, Purpo	ose and	l Impo	rtance	of Tim	e Mana	igement, I	3asic			
	Tips to Maintain T		. •	.,				4 .4	• • • •			
	•	solving activity: A sit			-		student	s and they	will			
	have to tell us how	to handle the situation	or solv	e the p	roblem	•						

#### **TEXTBOOKS:**

- T1. Wren, P.C and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
- T2. English Grammar in Use, Raymond Murphy 4th edition, CUP.
- **T3**. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

#### **REFERENCE BOOKS:**

- R1. English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- **R2**. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Analyse and identify the different types of sentences.	1,5
2	Able to integrate the skills of reading and speaking in professional communication.	1, 5, 9
3	Illustrate code Etiquette sessions will boost their confidence and morals.	5, 6, 9
4	Describe about the effective and efficient utilization of time.	5,9
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	1, 5, 9

			SEMESTER	– II								
Course T	Title		Partial Di	fferenti	ial equ	ation						
Course c	ode	24MSMT1201R	<b>Total credits: 4</b>	L	T	P	S	R	O/F		C	
			Total hours: 60T	3	3   1   0   0   0   0						4	
Pre-requi	isite	Nil	Co-requisite				Nil					
Program	mes		Master of Sci	ience in	Micro	biolog	gy					
Semest	er	S	pring/II Semester of	First Y	ear of	the P	rograi	nme	•			
Cours	e	1. To induce	with partial different	tial equ	ation a	nd abl	e to so	olve	first o	rder	linear	
objectiv	es	and non-linear PD	DE.									
		1	nigher order linear PD									
			tand the classification									
			e solution of Laplace	e's equa	ation, v	vave e	quatio	n, di	iffusio	n eq	uation	
		by separation of v										
			vave equation, heat ed	_					ction.			
CO1			d solution of first orde					Ξ.				
CO2			ing skill of linear PDE									
CO3			fication of second ord									
CO4			equation, wave equa	ation ar	nd diff	usion	equati	on 1	by sep	arati	ion of	
		variable.										
CO5	T		uation, heat equation		,							
Unit-		Conte	ent	СН	<b>Learning Outcome</b>				me		KL	
No.												
I		ics of partial differ	*			to solv					1,2	
		ear and nonlinear p		15	linear and non-linear PDE.							
	_	ation of the first or	•									
		hod of characteristi	•									
	1 -	ems of first order e Jacobi's method.										
TT				10	A 1-1 -	41-	1 1		1		1.2	
II		ear PDE with const	·	10	Able to solve higher order 1,2							
		ferent methods of s	_	linear PDE with constant coefficient.								
III		ond order PDE with		10		to ide		no tri	nos of		1,2	
111		fficients, classificat		10		nd orde	•	-	pes or		1,2	
		er PDE, Characteris			SCCOI	iu oruc	IIDL	٠.				
		and order PDE, Rec										
		onical forms. Solut										
			ethod of separation									
		ariables.	1									
IV	Lar	olace equation, Bou	ındary value	15	Able	to und	lerstan	d La	place'	s	1,2	
		olem, solution of L	•			tion, w			•		,	
	1 ^	aration of variable,			_	sion ec		-				
	_	nentary solutions of	-			paratio	_					
	dim	ensional Wave equ	ation, Solution of			-						
		Wave equation by										
	vari	ables Diffusion equ	uation, Elementary									
	solu	tions of the Diffus	ion equation,									
	Solu	ution of the Diffusi	on equation by									
	sepa	aration of variables	<u>.                                    </u>									
V		en's function, Gree		10	Able	to und	lerstan	d wa	ave		1,2	
	_	lace's equation, wa	ive equation and		_	tion, h	_					
	Diff	fusion equation.		terms	s of Gr	een's	func	tion.				

#### **TEXTBOOKS**

- T1. Sneddon, I. N. (2006), Elements of Partial Differential Equations, Dover Publications, Inc.
- T2. Rao, K. S. (2010), Introduction to Partial Differential Equations, PHI Learning Pvt.Ltd..

#### REFERENCE BOOKS

- R1. Raisinghania, M. D. (2010), Advanced Differential Equations, 18th Edition, S Chand,
- R2. Bhamra, K. S. (2010), Partial Differential Equations, PHI Learning Pvt. Ltd.

#### OTHER LEARNING RESOURCES:

- 1. http://mathforum.org
- 2. http://ocw.mit.edu/ocwweb/Mathematics
- 3. http://www.opensource.org

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe PDE and solution of first order linear and non-linear PDE.	1, 2
2	Describe the solving skill of linear PDE with constant coefficient.	1, 3, 4
3	Explore the classification of second order PDE, characteristic curve etc.	1, 2, 3, 4
4	Solve Laplace's equation, wave equation and diffusion equation by separation of variable.	1, 2, 4
5	Describe wave equation, heat equation in terms of Green's function.	1, 2, 3, 4

SEMESTER – II											
Course T	Title		Linea	r Alg	gebra						
Course c	ode	24MSMT1202R	Total credits: 4	L	T	P	S	R	O/F		C
			Total hours: 60T	3	1	0	0	0	0		4
Pre-requi		Nil	Co-requisite				N	il			
Program			Master of Scient								
Semest			pring/II Semester of F					amn	ıe		
Cours			on to vector space, basis								
objectiv	1	· ·	of linear transformatio	n, rep	present	tation	of lir	near	transto	ormat	ion by
		matrices, rank nul	•	1	:	1:4:-	:	:	. 4		
			Eigen value, Eigen vecto		_					pace.	
			tand diagonal form, Jord nner product space, orth						oriii.		
CO1		<u> </u>	ce, linear dependence a						s and c	limon	sion
CO2			sformation, representat								
		nullity theorem.	sioimanon, representat	1011 01	i iiiiCal	1 11 111 15	1011116	ıtıUII	оу ш	1111CC	s, rank
CO3	- 1	•	solving techniques lik	e fina	ding F	ligen y	value	Fio	en ve	ctors	linear
			• .		_	5-11	,	, 2.5	,-11 ,0	- 0010,	micul
CO4		dependence, independence, rank and nullity etc.  Describe diagonal form, Jordan and rational canonical form.									
CO5		Define inner product space along with linear functionals and different kinds of									
		operators.	1 0								
Unit-		Con	tent	СН	-	Lea	rning	Out	come		KL
No.											
I	Vect	or spaces, sub spa	ces, linearly	15	Ał	ole to l	cnow	vecto	or spac	ce,	1,2
	1 1	-	ent set, Basis and dimension, sums linear dependence and								
	and	direct sums.		independence of set, basis			S				
						d dime					
II			and Operator, rank	10		ole to l			inear		1,
			atrix representation of			nsforr		-			2
				Annihilating representa						2.0	
	pory	nomial of a linear	transformation.			nk null		-	matric m	es,	
					lai	ik iiui	iity tii	COIC	111.		
III	Eige	n values and eiger	vectors, invariant	10	Ał	ole to l	now	Eige	n valu	e.	1,
	-	· ·	s apples to operators,			gen ve		-		-,	2
		nentary Canonical			1	_			varian	t	
	diag	onalization and tri	angulation of linear		su	bspace	;				
	oper	ators.									
IV	Deco	omposition of an o	perator, Jordan and	10	Ał	ole to 1	ınder	stand	diago	nal	1,
	ratio	nal canonical forn	1.						ational		2
						nonica					
V		-	orthogonal bases,	15			-		r prod	uct	1,
			djoints, self-adjoint		_	ace, or	_				2
		normal operators,	_			thonor					
		nal operators on re	•						ferent		
	spaces, positive operators, Isometries.				K11	nds of	opera	tors.			

#### **TEXTBOOKS:**

- T1. Strang, G. (2005). Linear Algebra and its Applications. Cengage Learning.
- T2. Saikia, P. K. (2014). Linear Algebra. Pearson Education India.

#### **REFERENCE BOOKS:**

R1. Artin, M. (2015). Algebra. Pearson Ed. India.

R2. Axler. S. (1997). Linear Algebra Done Right. Springer.

#### OTHER LEARNING RESOURCES:

1. MIT OCW 18.06SC: Linear Algebra by Gilbert Strang.http://ocw.mit.edu./

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Define vector space, linear dependence and independence of set, basis and dimension.	1,6
2	Define linear transformation, representation of linear transformation by matrices, rank nullity theorem.	1, 2, 3, 4, 6
3	Explore problem solving techniques like finding Eigen value, Eigen vectors, linear dependence, independence, rank and nullity etc.	1, 2, 3, 4, 6, 8
4	Describe diagonal form, Jordan and rational canonical form.	1, 4, 8
5	Define inner product space along with linear functionals and different kinds of operators.	1, 2, 7, 8

		SEMESTER	– II							
<b>Course Title</b>		Comp	lex Ana	lysis						
Course code		Total credits: 4	L	T	P	S	R	O/F	C	
		Total hours: 60T	3	1	0	0	0	0	4	
Pre-requisite	Nil	Co-requisite				N	il			
Programme		Master of Scie								
Semester		Fall/ I semester of fir	-			-				
Course		the concepts of limit,						_		
Objectives	1	with the knowledg		-						
	1 -	logarithmic functio	n, trigo	onome	tric,	hyp	erbolio	e and	inverse	
	trigonometric functi			. •		. 1		.1		
		ic properties of comp	_		and 1	the va	arious	theorems	related	
		heorem, Morera's the					1 :		c	
		owledge of convergen	ice of se	quence	e, ser	ies ar	ia unic	queness o	i series	
	representation.	ha ragidua thaaram	racidua a	t o fin	ita n	oint :	racidu	og at tha s	oint at	
	4. To understand t infinity, Rouche's th	he residue theorem, i	residue a	ıaııı	ne po	omi, i	residue	es at the p	omi ai	
	1	he concept of conform	nal manr	sings o	nd ni	roblar	ng role	stad to it		
CO1		t of limit, continuity,							on	
CO2	1	operties of complex is		•		•			011.	
CO3		ept of convergence							series	
	representation.	pt of convergence v	or seque	nice, s	,01103	und	umqe	acticss of	SCIICS	
CO4	Describe the residue theorem, residue at a finite point, residues at the point at infinity									
	etc.									
CO5		t of conformal mappi	ngs and	proble	ms re	elated	to it.			
Unit-No.	Conte		Contact				g Outc	ome	KL	
			Hour							
I	Functions of Con	nplex variables,		Stı	udent	ts wi	ll be	able to	1,	
	Mappings by expon	ential functions,	15	un	derst	and t	he coi	ncept of	2	
	limits, continuity, der	· · · · · · · · · · · · · · · · · · ·			nit,		coı	ntinuity,		
	Riemann equation	· · · · · · · · · · · · · · · · · · ·			rivab	-		analytic		
	functions, Harmon	´		fui	nctio	ns etc	·.			
	Reflection principles,	•								
	functions, logarith	·								
	branches and derivati	•								
		, trigonometric olic functions,								
	functions, hyperbo									
1	invarca triconomotrio								į į	
	inverse trigonometric	functions.	10	Sta	udant	to w	ill la	orn the	1	
II	Basic properties	functions.  of Complex	10					arn the	1,	
II	Basic properties Integration, Caucl	functions.  of Complex hy's theorem,	10	pro	opert	ies		complex	1, 2	
II	Basic properties Integration, Caucl Morera's theorem,	functions.  of Complex hy's theorem, Cauchy Integral	10	pro int	opert tegrat	ies tion,	of c	complex some		
II	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's	functions.  of Complex hy's theorem, Cauchy Integral series, The	10	pro int	opert tegrat	ies tion,	of c	complex		
II	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz	10	pro int	opert tegrat	ies tion,	of c	complex some		
II	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz	10	pro int	opert tegrat	ies tion,	of c	complex some		
II	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz	10	pro int	opert tegrat	ies tion,	of c	complex some		
II	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz eorem.	10	pro int the	opert tegrat	ies tion, ns and	of o	complex some		
III	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p lemma, Liouville's the	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz eorem.		pro int the	opert tegrat eoren udent	ies tion, ns and	of of definition of the officers of the office	some some ed to it.	2	
III	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p lemma, Liouville's the	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz eorem.  Sequences, es, Taylor series,		pro int the	opert tegrat eoren udent owle	ies tion, ns and ts w	of of drelated	some ed to it.	2	
III	Basic properties Integration, Caucl Morera's theorem, formula, Laurent's Maximum modulus p lemma, Liouville's the Convergence of convergence of serie	functions.  of Complex hy's theorem, Cauchy Integral series, The rinciple, Schwarz eorem.  Sequences, es, Taylor series,		pro int the	opert tegrat eoren udent owle	ies tion, ns and ts w	of of drelated	some ed to it.	1, 2,	

IV	Residue at a finite point, residue at the point at infinity, residue theorem, number of zeros and poles, argument principle, Rouche's theorem, evaluation of integrals, application of residues, Jordan's lemma, Indented paths.	10	Students will have the knowledge of residues and its related concepts.	1, 2, 3
V	Linear transformation, linear fractional transformation, mappings of upper half plane, the transformation w=sin z; mappings of z ² and branches of z ^{1/2} , square roots of polynomials, preservation of angles, scale factor, local inverses, harmonic conjugates, transformation of harmonic functions, applications.	15	Students will be able to understand the concept of conformal mappings.	1, 2

#### **TEXTBOOKS:**

- **T1**. Brown, J. W., Churchill, R.V. (2009), Complex variables and applications, Boston: McGraw-Hill Higher Education.
- T2. Agarwal, R. P., Perera, K. Ans Pinelas, S., An Introduction To Complex Analysis, Springer-Verla's, 2011.
- T3. Narasimhan, R., Complex Analysis in one variable, Birkhauser, Boston, 1984.

#### **REFERENCE BOOKS:**

- R1. Karunakaran, V. (2005), Complex Analysis, Alpha Science Int'l Ltd.
- R2. Rubin, W. (2006), Real and Complex analysis, Tata McGraw-Hill Education.

CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the concept of limit, continuity, derivability of a complex variable function.	1, 6					
2	Explore the basic properties of complex integration and theorems related to it.	1, 3, 4, 7					
3	Describe the concept of convergence of sequence, series and uniqueness of series representation.	1, 3, 4, 6, 8					
4	Describe the residue theorem, residue at a finite point, residues at the point at infinity etc.	1, 2, 3, 4, 8					
5	Describe the concept of conformal mappings and problems related to it.	1, 2, 3, 4, 8.					

					SEME	ESTE	R – II											
Course T	itle		Re					nd Stati	stical	Ana	lysis	8						
Course code		24MSMT210	5R	l l	otal cre				L	T	P	S	R	O/F	C			
				To			30T+15	P	2	0	2	0	0	0	3			
Pre-requi		Nil					quisite					Nil						
Programi								in Math										
Semeste								Year of						_				
Course		1. The course											_					
objectiv	es	methodology, including theory of science and qualitative and quantitative methods																
		<ul><li>in research.</li><li>The course seeks to enhance the students' skills for developing critical thinking</li></ul>																
											_	_			_			
		through res develop sk										_	-					
		project/Mir				ration	or a	research	prop	)05a1	101	а	mas	ter the	; 515			
		3. To develo				mnete	ency in	nlannii	າσ ເ	ondu	ctin	σε	valu	ıatino	and			
		presenting a				_	iney in	Piainin	15, 0	Ollau	i C tiii	5, •	vara	ating	ana			
CO1		Students will ha					f Resea	rch meth	ods.									
CO2		Students will ga								7.								
CO3		Students will be																
CO4							_			Report/dissertation Procedure.								
CO5		Students will a	cquir	ire k	knowled	dge o	of vario	us asp	ects	of I	PR,	incl	udin	g pat	ents,			
		trademarks, copyrights, industrial designs, traditional knowledge and geographical																
	indications.																	
Unit-						C	Content											
No.																		
I		earch Methodology- An Introduction- meaning and objectives of research, motivation																
		esearch,																
		esandsignificanceofresearch, criteria of goodresearch. Defining the Research Problems-																
TT	1	initionofresearchproblem, necessity of defining research problem earch Design- meaning and need of research design, features of a good design,																
II																		
	1	erent research designs, Sampling Design- steps in sampling design, Sample Size rmination, criteria for selecting a sampling design, different types of sampling design,																
		erimental Design, Principles of Design of Experiment, One –way ANOVA, Two-Way																
	_	OVA, CRD,RBD, LSD, 22,23Factorial Design																
III		bes of data, sources of data collection, tools of data collection, Nominal, ordinal,																
		rval and ratio –Attitude scale construction and measurement, rating scales, semantic																
	diffe	erential (SD),Use of scale in statistical analysis, Schedules for interviews preparation																
	and	standardization, development of survey instruments and item analysis for the																
	ques	stionnaire.																
IV		nning and organizing research report, Format of research report, Different steps of																
	writ	ting report, Layout of there search report, how to organizethesis /Dissertation,																
		chanics of writing research report, standard methods of quoting- presenting the result,																
		tten and oral reports, Uses of abstract, format of research report, presentation of																
		istics - tabular and graphic references and uses of references, Bibliography and																
	_	esentation of bibliography.																
V		ellectual property right (IPR), Introduction and the need for IPR, IPR in India and rldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design																
							_			-					-			
		litional Knowled nting life, Filing	_		_	_							_					
	•	em, Case studies	•	•	• •				•		110 11	nern	iali0]	nai pai	CIII			
	syste	ziii, Case studies	on B	oasm	iaurice,	, i urm	nerie, ar	iu neem	paten	us								

Labora	Laboratory using R Software:						
tory	1. Analysis of One way ANOVA;						
	2. Analysis of Two way ANOVA;						
	3. Analysis of CRD						
	4.Analysis of RBD						
	5. Analysis of 22 and 23 Factorial Experiment						
	6. Simulation-using R (Bernoulli, Binomial, Poisson and Geometric distribution.).						
	7.7 Simulation-II using R (Exponential and Normal distribution).						
	8 Simple random Sampling/ Stratified Random Sampling						

SEMESTER – III												
<b>Course Title</b>												
Course code	24MSMT2101R	Total credits: 3		L	T	P	S	R	O/F	C		
		Total hours: 30T-		2	0	2	0	0	0	3		
<b>Pre-requisite</b>	Nil	Co-requ		Nil								
Programme	Master of Science in Mathematics											
Semester	Fall/ I semester of first year of the programme											
Course	•	1. To provide an overview of C, various operators, loops and statements.										
Objectives		c ideas and propertie				id se	archi	ng ai	nd sor	ting.		
		3. To know various functions in C and analyze their arguments.										
	T	1. To analyze the idea of pointers, their expressions, array of pointers.										
	-	ons on files in C and	* *	epts, crea	atıon	of a	lınke	ed lis	st.			
CO1		ators, loops and state				1						
CO2		nd properties of arra		s search	ıng a	nd so	orting	<b>z</b> .				
CO3		C and analyze their	~									
CO4	· ·	ot of pointers, their e	-		_		1 1	1				
CO5 Unit-No.	_	s on files in C and ty								TZT		
Unit-No.	Cont	ent	Contact Hour	Le	arnı	ng C	utco	me		KL		
I	Revision of fundam	vantals of C. Data	nour	Introd	1100	***	ith	ho	sic			
1	types in C, variables		conce									
	statements, const		operat			ops		nd				
	arithmetic operators		statem			ops	а	illu				
	expressions, assign	7	Statem	CIICS	•							
	arithmetic assign	,							1,2			
	increment and dec								1,2			
	type conversion	•										
	precedence. for lo	· 1										
	dowhile loop, if s											
	statement, swit	ch statement,										
	conditional operat	ors. The break										
	statement, the conti	nue statement, the										
	go-to statement.											
II	Arrays: Arrays, de	claration of one-		Able	to :	learn	the	ba	sic			
	dimensional arrays,	two dimensional		ideas	and	pr	opert	ies	of			
	arrays. Structures a	and Unions: User		arrays					nd			
	defined data types, s		7	search	ing a	and s	orting	g.		1,2		
	structures, unions,											
	type. Searching and											
	sort, selection sor											
	linear search and bir	-		411						1.0		
III	Function in C: S		Able		lea		vario		1,2			
	passing arguments		6									
	reference, overloade	•		arguments.								
	functions, default ar											
IV	Pointers: Introduce			Able 1	to 12	10117	the :	idea	of	1,2		
"		variable; pointer		pointe						1,4		
	declaration, initiali	-	5	array			_	,001U.	,			
	variable through	-		urruy	· Po		٠.					
	pointers; pointe											
	r 5 pointe											

V	increment and scale factor. Pointers and Arrays. Array of pointers. Pointers as function arguments  Files in C: Defining and opening a file, closing a file. Input/Output operations on files. Dynamic Memory Allocation and Linked list: Dynamic memory allocation, Malloc, Calloc, Free, Realloc. Concepts of linked list, types of	5	Able to learn operations on files in C and types, concepts, creation of a linked list.	1,2
	advantages of linked list, types of linked list. Creating a linked list.			
Practical	<ul><li>(i) C-Programming</li><li>(ii) Mathematica</li><li>(iii) Latex</li></ul>	30	Able to solve various mathematical problems using Mathematica	1, 2, 3

- T1. Rajaraman, V. Fundamentals of Computers (Prentice Hall of India, New Delhi, 2002).
- T2. Balaguruswamy, E. Programming in ANSI C (Tata McGraw-Hill, 2004).

#### REFERENCE BOOKS

- R1. Kanetkar, Y. P. Let us C (BPB Publication, 2001).
- R2. Venkateshmurthy, M. G. Programming Techniques through C (Pearson Education, 2002).

#### OTHER LEARNING RESOURCES:

- 1.https://www.w3schools.com
- 2.https://edu.gcfglobal.org
- 3.https://www.tutorialspoint.com
- 4. https://www.javatpoint.com

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explore C, its operators, loops and statements.	1							
2	Describe the idea and properties of arrays, data types searching and sorting.	1,3							
3	Define functions in C and analyze their arguments.	5							
4	Describe the concept of pointers, their expressions, array of pointers.	2, 5							
5	Describe operations on files in C and types, concepts, creation of a linked list.	2, 5							

SEMESTER – III									
Course Title	RESEARC	RESEARCH PROJECT I (RESEARCH/ INDUSTRY INTERNSHIP)							
Course code	24MSMT2105R	24MSMT2105R Total credits: 4 L T P S R O/F C							
		Total hours:	2	1	0	4	0	0	4
Pre-requisite	Nil	Co-requisite			•	N	il		
Programmes		Master of Scien	ce in	Math	emati	cs			
Semester	S	pring/II Semester of Fi	rst Y	ear of	f the P	rograi	nme		
Course	1. To learn	the principles of desig	gning	effec	tive s	urveys	, inclu	ding qu	estion
Objectives	formulation	on and sampling technique	ies.						
	2. To gain ha	ands-on experience in de	signi	ng and	d cond	ucting	researc	h experi	ments
	to test hyp	ootheses							
CO1	Formulate research	h methodology							
CO2	Prepare research t	tool(s)							
CO3	Apply the knowledge of sampling methods in sample collection.								
CO4	Design experiment using scientific method								
CO5	Investigate the res	earch Problem							

	SEMESTER – III								
Course T	Title	T	opolog	gy					
Course c	ode 24MSMT2106R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 60T	4	0	0	0	0	0	4
Pre-requ	isite Nil	Co-requisite				Ni	il		
Program	mes	Master of Scient	ence in	ı Matl	nemat	ics			
Semest		Spring/II Semester of l					mme	e	
Cours	_								
Objectiv	_	results of classical anal			-		_		
		pe relationship of contin	•						
		pe relationship of contin	-						
		be relationship of contin	uity w	vith Se	parati	on axio	oms.		
CO1		c topological concepts.							
CO2	*	ts of classical analysis i				etting.			
CO3		hip of continuity with o							
CO4		ship of continuity with							
CO5	Explain relations	hip of continuity with S	eparat	ion ax	ioms.				
	T	<del></del>		1 6	I				777
Unit-		Content		<b>C</b>	H   .	Learni	ing (	Outcome	KL
No.	Dania and and	41	1	_	-	T., 4., 1.,			
I	_	topology, Metric top				Introdu basic			
	spaces.	logy, order topology, q	uonen	ւ   1		oasic concep	_	oological	1,2
II		first countable spaces,	secono	1 1		Prove		ults of	f I
11	1	rable spaces, Lindelöf						alysis in	
	countable spaces, sepa	rable spaces, Efficient	spaces	•			ore	general	
						setting		genera	
III	Compactness, limit	point compactness,	loca	1 1		Able	to	obtain	1,2
	compactness, one-poin				-	relation	nship		
		theorem, Baire spaces	Baire	e		continu	•	with	1
	category theorem.					compa	•	S	
IV	Connectedness, Lo	cal connectedness,	Path	h 1	0 .	Able	to	obtain	1,2
connectedness, Components, Products of connected				d l	1	relation	nship	of	f
spaces. continuity with					1				
connectedness,					ess,				
V	Separation axioms, H	ausdorff, regular and l	Vorma	1 1	5	Able	to	obtain	1,2
	spaces, Urysohn'sch	araterization of nor	mality	,	1	relation	nship	of	f
	· ·	theorem, Tietze's ext	ension	n		continu	•	with	ı
	theorem, Completely	theorem, Completely regular spaces.						axioms	

- T1. Munkres, J. (2015). Topology, Pearson.
- **T2.** Simmons, G. F., Hammitt, J. K. (2017). Introduction to topology and modern analysis. New York: McGraw-Hill.

#### REFERENCE BOOKS

- R1. Lipschutz ines. New York: McGraw-Hill.
- R2. Kelley, J. L. (1975). General Topology. Springer.

#### OTHER LEARNING RESOURCES

- 1. <a href="http://mathforum.org">http://mathforum.org</a>
- 2. http://ocw.mit.edu/ocwweb/Mathematics

#### 3. http://www.opensource.org

	CO PO Mapping							
SN	SN Course Outcome (CO)							
1	Describe the basic topological concepts.	1, 4, 9						
2	Explore the results of classical analysis in a more general setting.	1, 4, 5						
3	Analyze relationship of continuity with connectedness.	1, 4, 5						
4	Describe relationship of continuity with compactness.	1,4						
5	Explain relationship of continuity with Separation axioms.	1, 3, 4						

			SEMESTE	R-III									
Course 7	Γitle		Mech	anics and	l Ten	sor							
Course o	code	24MSMT2107R	<b>Total credits: 4</b>	L	T	P	S	R	O/F	C			
			Total hours: 60T	4	0	0	0	0	0	4			
Pre-requ	isite	Nil	Co-requisite			•	N	il					
Program	ıme		Master of S	cience in	Mat	hemat	ics						
Semest	er		Fall/ III semester o	of first ye	ar of	the pr	ograi	nme					
Cours	se	1. To introduce w	ith motion of three	dimension	ı in cy	ylindri	cal an	d pola	r co-ordir	nate			
Objecti	ves	form.		·									
			about motion of a ri										
		3. To understand generalized co-ordinate, Lagrange's equation of motion in different											
		dynamical syst											
			4. To know tensors and its operations.										
			riant derivatives of t						2				
CO1			nensional motion in	-			co-oro	linate	form.				
CO2		_	a rigid body and its				. •		20				
CO3		_	zed co-ordinate, Lag	range's e	quatic	on of r	notion	ın dif	terent dy	namıcal			
601		system.	1:4										
CO4		Explore tensors an		عا: <b>ل</b> ـ مـ م		1:+:							
CO5 Unit-		Conte	derivatives of tensor	Contac				- O4		KL			
		Conte	nı	Contac Hour	:	Lea	arnınş	g Outo	come	KL			
No.	Mot	tion in three dimens	vione volocity and	Hour	I	ntrodu	100 111	th thro					
1		eleration in cylindri	· · · · · · · · · · · · · · · · · · ·			limens				1,2			
	pola	•	cai and spherical	10		ylindr				1,2			
		ordinates, motion of	Ceylindrical	10		ordinat			ai co-				
	ı	erical and conical so			`	Ji dilla	. 10111	.1					
II		tion of a rigid body			ŀ	Znow1	edge a	bout r	notion				
	1	ions, Carnot's theo	-			of a rig	-						
		orem	,			elated		-		1,2			
	and	Bertrands theorem	motion of a rigid	10						1,2			
		y about a fixed poin	~		,								
	Geo	metrical and Dyna	nical systems,										
	mot	ion under external	forces.										
III	Ger	neralized coordinate	s, Lagrange's		I	Knowl	edge o	of gene	eralized				
	equ	ation of motion for	finite and		0	co-ordi	inate,	Lagrar	nge's	1,2			
	imp	ulsive forcesin hold	onomic systems,	10	6	equatio	on of r	notion	in				
	Cas	e of conservative fo	orces and theory		(	differe	nt dyn	amica	l system				
		mall oscillation											
IV		nsformation laws of							ors and				
		travariant tensors, N			i	ts ope	rations	8					
		ık oftensors, symme								1,2			
	-	metric tensors and											
	_	ebraic operations of											
		traction, Inner and	-	7									
		sors, Quotient law, g		-									
		sors, Christoffel's b											
		second kinds, their											
		mannian metric Det											
		sors, Transformation	n laws of										
	Chr	istoffel brackets.											

V	Covariant derivatives of tensors		Able to know Covariant	
	$A_i$ , $A^i$ , $A_{ij}$ , $A^{ij}$ and $A^i_j$ , Generalizations,		derivatives of tensors and	
	Covariantderivatives of . metric tensors		its generalizations	1,2
	and scalar invariant function,	8		
	Application in problems. Angle between			
	two vectors, Curl, grad, divergence of			
	vectors.			

T1. An introduction to Riemannian Geometry and Tensor Calculus, Cambridge University Press.

#### **REFERENCEBOOKS:**

- R1. Riemannian Geometry, Princeton University Press (1949) LP Eisenhart
- R2. Tensor Calculus and Riemannian Geometry D C Agarwal, Krishna Prakasahan Media (P) Ltd.
- R3. Dynamics, Part II, A. S. Ramsey, Cambridge University Press

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe three dimensional motion in cylindrical and polar co-	1 2 4							
1	ordinate form.	1, 2, 4							
2	Explain motion of a rigid body and its related results.	1, 2, 3, 4, 8							
3	Describe generalized co-ordinate, Lagrange's equation of motion in	1 2 2 4 7							
3	different dynamical system.	1, 2, 3, 4, 7							
4	Explore tensors and its operations.	1, 2, 3, 4, 7							
5	Define Covariant derivatives of tensors and its generalizations.	1, 2, 3, 4, 8.							

			SEMESTE	R-III						
Course 7	Γitle		Func	tional A	nalys	is				
Course	code	24MSMT2108R	Total credits: 4	L	T	P	S	R	O/F	C
			Total hours: 60T	4	0	0	0	0	0	4
Pre-requ		Nil	Co-requisite				N	il		
Progran			Master of So							
Semest		1 75 1	Fall/ III semester o							1
Cours			and the classical I							
Objecti	ives		s inequality; converger functional on L ^p s	_		_				ieoren
			neral Banach spaces,	_		_				norme
			; Hahn-Banach theor					14110115	octween.	HOTHIC
		_	nd embedding of a r			_		g and	weak tone	ologie
			g theorem, uniform b			_		5 una	weak top	Jiogie
			out Hilbert's spaces					l's ine	aualities.	Gran
			ogonalization proces		1 1	,			,	
			d normal and unitary		rs, pro	ojectio	ns, spe	ctrum	of an ope	rator,
			rem for a normal ope	-	_	-	_		_	
CO1		Describe the conce	ept of classical Bana	ch space	s and	l its re	lated 1	esults,	L ^p space	s alor
		with inequalities.								
CO2		Define General Baı	nach spaces, Hahn-Ba	anach the	orem	and it	s cons	equenc	es.	
CO3		Describe embeddir	ng of a normed line	ear space	, stro	ong ar	d wea	k topo	logies an	d ope
		mapping theorem.								
CO4			spaces and its proj	perties, I	Besse	l's ine	equaliti	es, and	d Gram-S	Schmi
		orhtogonalization p								
CO5			unitary operators, pro							
Unit-		Conte	nt	Contac	t	Le	arning	g Outc	ome	KL
No.	Cl	-:1 D1	т р	Hour	C4	1 4 .	:11 1	1.	4	
I		sical Banach spaces ler's inequality, Mir	-					earn ab 1 space		
		uality; convergence		10			s inequ	•	8,	
	_	z-Fischer theorem,	•				_	anty, 1equali	tv	1,2
		tional on L ^p spaces,			'''	IIIKOW	SKI S II	requair	ty.	
		esentation theorem.	Tuesz							
II	•	eral Banach spaces-	definition and		St	udents	s will h	ave		1,
		nples; continuous li		10				of Gen	eral	2
		formations between					_	, contir		
	spac	es; Hahn-Banach th	eorem and its		lir	near tr	ansfori	nations	between	
	_	equences.			no	ormed	linear	spaces.		
Ш	Emb	edding of a normed	linear space in its		St	udents	will le	earn bo	ast	
	seco	nd conjugate space;	strong and weak		th	eembe	dding	of a no	rmed	1,
	_	logies; open mappir	-	15		_			d strong	2,
		h theorem; uniform						en map	ping	3
		rem; conjugate of a				eorem				
IV		ert's spaces, examp	•						out the	
		erties, orthogonal c						ert's sp		
		onormal set, Bessel	-	10				propert		1,
		plete orthonormal s				_			lisation	2
		ogonalization proce	ss, self adjoint				ım Sch			
<b>X</b> 7	•	ators.		1-				on pro	cess.	1
V	Nori	nal and unitary ope	rators, projections,	15	St	udents	s will h	ave		1,

spectrum of an operator, spectral theorem	understanding of normal and	2,
for a normal operator on a finite	unitary operators, projections,	3
dimensional Hilbert space.	spectrum of an operator,	
	spectral theorem on a finite	
	dimensional Hilbert space.	

- T1. Kreyszig, E. (1978), Introductory functional analysis with applications, New York: Wiley.
- T2. Choudhury, B., Nanda, S. (1989), Functional analysis with applications, Wiley.
- T3. Limaye, B. V. (2014), Functional Analysis, New Age International Pvt. Ltd.

#### **REFERENCEBOOKS:**

- R1. Ponnusamy, S. (2002), Foundations of functional analysis, CRC Press.
- **R2**. Jain, P. K., Ahuja, O.P., Ahmed, K. (1995), Functional Analysis, New Age International Pvt. Ltd.**R3**. Dynamics, Part II, A. S. Ramsey, Cambridge University Press.

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the concept of classical Banach spaces and its related results, L ^p spaces along with inequalities.	1, 2, 4							
2	Define General Banach spaces, Hahn-Banach theorem and its consequences.	1, 2, 3, 4, 8							
3	Describe embedding of a normed linear space, strong and weak topologies and open mapping theorem.	1, 2, 3, 4, 7							
4	Describe Hilbert's spaces and its properties, Bessel's inequalities, and Gram-Schmidt orhtogonalization process.	1, 2, 3, 4, 8							
5	Define normal and unitary operators, projections, spectrum of an operator etc.	1, 2, 3, 4, 6							

			SEMEST	ER-III						
Course T	itle			umber The	eory					
Course c	ode	24MSMT2109R	Total credits: 4	L	T	P	S	R	O/F	С
			Total hours: 60T	4	0	0	0	0	0	4
Pre-requ	isite	Nil	Co-requisite				N	il		.1
Program	me		Master of	Science in I	Matl	hematic	S			
Semest	er		Fall/ III semester	of first yea	r of	the pro	gramn	ne		
Cours	e	1. To understar	nd Euclidean algorithm	n, Fermat's 1	theo	rem, Eul	ler's Tl	neorem,	, Wilson's	
Objectiv	ves	theorem.								
			gruence module, prim	itive roots,	quad	ratic res	idues,	Legend	re symbol,	
		Quadratic Reciprocit	•							
			nd greatest integer fund	ction, arithn	netic	function	ns, Mo	bius inv	version for	mula,
		Fibonacci numbers a				CD 4			C.	C
			nd Diophantine equation	ons, properti	ies o	f Pythag	gorean	triples,	sums of tw	o, four
		and five squares.	l 4: 1	e::4 1 :		44:	1 C	4:	TT	
		5. To learn simple theorem, Pell's equa	le continued fractions,	finite and ir	nIini	te contir	iuea ira	actions,	Herwitz's	
CO1			algorithm, Fermat's t	haaram Eu	1100%	thaara	m Wi	laan'a t	haaram ar	d solve
COI		problems related to t	•	ncoreni, Eu	iici s	s ulcore	111, VV 1	15011 S l	neoreni ar	ia soive
CO2		•	nodulo, primitive roots	quadratic	resid	lues and	descri	he their	nronerties	
CO3			st integer function, a	-						
200		properties.				, 1111		1		
CO4			Describe Diophantine equations, properties of Pythagorean triples, sums of two, four and five							
		squares.								
CO5		Describe simple con	ntinued fractions, finit	e and infin	nite (	continue	d fract	tions ar	nd solve p	roblems
		related to it.								
Unit-		Conte	nt	Contact		Le	arning	Gutco	me	KL
No.				Hour						
I		risibility; Euclidean al	_			Students				
		gruences; Fermat's th		10	- 1		_		ermat's	
		orem and Wilson's Th	·		- 1	heorem,			em,	1,2
	1 -	tients and their eleme	•		'	Wilson's	theore	em.		
		utions of congruences orem; Euler's phi-fun								
II		ngruences modulo, po		15	-	Students	will la	orn obo	t	
11		ver residues, primitive		13	- 1				owers of	1,
	_	stence; quadratic resid			- 1	orime, q		_		2
		nbol, Gauss' Lemma a	_		1 -	Legendr			,	
		nbol; Quadratic recipr	•			8	,			
	_	ious formulations.	•							
III		eatest integer function			- 1	Students				
		ctions, multiplicative				about the	_	_		
		ementary ones); Mobi			- 1	function				1,
		mula; convulation of a		10		and will			ve .	2,
		oup properties of arith			1	problem	s relate	d to it.		3
		urrence functions; Fib	onacci numbers and							
IV		ir properties.  ophantine equations-so	dutions of outle		-	Students		21/6		+
1 V		y ² =z ² ; properties of P	•		- 1	students indersta			hantine	
		y = z, properties of rand fiven sof two, four and fiven			- 1		_	_	namme n triples,	1,
		mples of Diophantine	=	10	- 1	sums of	-	_	-	2
	)		I		- 1	squares a			· <del>-</del>	-
					- 1	issociate	_			
V	Sin	ple continued fractio	ns, finite and infinite	1.5		Students				1,
		tinued fractions, uniq		15	ι	ındersta	nding o	of simpl	le	2,

representation of rational and irrational	continued fractions, finite and	3
numbers as simple continued fraction,	infinite continued fractions,	
rational approximation to irrational numbers,	Herwitz theorem, Pell's	
Herwitz theorem, basic facts of	equation.	
periodiccontinued fractions and their		
illustrations, Pell's equation.		

- T1. Burton, D. M., Elementary Number Theory, Wm.C. Brown Publishers, Dulreque, Lowa, 1989.
- **T2**. Kenneth, H. Rosen, Elementary Number Theory and its Applications, AT&T Bell Laboratories, Addition-Wesley Publishing Company, 3rd Edition.

#### **REFERENCEBOOKS:**

- R1. Gareth, A. Jones and J Mary Jones, elementary Number Theory, Springer International Edition.
- R2. Richard A Mollin, Advanced Number Theory with Applications, CRC Press, A Chapman & Hall Book.
- **R3**. SabanAlaca and Kenneth S Williams, Introduction to Algebraic Number Theory, Cambridge University Press.

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Describe Euclidean algorithm, Fermat's theorem, Euler's theorem, Wilson's theorem and solve problems related to these.	1, 2, 4							
2	Define congruence modulo, primitive roots, quadratic residues and describe their properties.	1, 2, 3, 4, 8							
3	Explore the greatest integer function, arithmetic function, multiplicative function and their properties.	1, 2, 3, 4, 7							
4	Describe Diophantine equations, properties of Pythagorean triples, sums of two, four and five squares.	1, 2, 3, 4, 8							
5	Describe simple continued fractions, finite and infinite continued fractions and solve problems related to it.	1, 2, 3, 4, 7							

			SEMESTE	R-III							
Course	Title		Flu	ıid Dyn	amio	es					
Course	code	24MSMT2110R	Total credits: 4	L	T	P	S	R	O/F	С	
			Total hours: 60T	4	0	0	0	0	0	4	
Pre-requ	iisite	Nil Co-requisite N						il			
Progran	nme		Master of Science in Mathematics								
Semest	ter		Fall/ III semester o	f first y	ear (	of the pr	ogran	nme			
Cours	se	1. To introduce	with waves and its	basic co	ncep	ots.					
Objecti	ives		stress-strain relations	_							
			two and three-Dimer	nsional I	nvis	cid Fluid	l Flow	s and i	ts related		
		results.									
			me exact solutions o	f Navier	-Sto	kes equa	tions	under o	different		
		geometries.									
601			Laminar boundary la	ayer.							
CO1		Define waves and i	_		<u> </u>	• 1					
CO2			ain relationship of No								
CO3			hree Dimensional In								
CO4			xes equations under c								
CO5 Unit-	<u> </u>		boundary layer and E	Conta			<b>:</b>	. 040		1/1	
No.		Conte	nι	Hour		Lea	arnınş	g Outc	ome	KL	
I I	Woxe	es: Long wave and	surface ways and	Hour		The stud	lanta x	rill 1001	m about		
1	l .	ce, stationary wave									
	l .	aves, Waves betwe	10		the properties, energy, and effects of surface tension in						
		p velocity, Dynami	10		different				1,2		
	1 1	p velocity, Surface			different	types	or wa	<b>v c</b> 5.	1,2		
	_		s of Surface tension								
	l . –	ter waves.									
II	Kiner	matics of Fluids in	motion & Stress		-	The stud	lents v	ill lear	n about		
	and S	train Analysis: Me	thods of describing		1	the math	emati	cal des	cription		
	fluid	motion, material, le	ocal and	1.5	.	of fluid 1	i, stress	s-strain			
	conve	ective derivatives, 1	path lines, stream	15		analysis,	, and c	onserv	ation	1	
	lines,	vortex lines, strain	and its types,			laws.				1, 2	
	small	deformation theor	y, stress vector and								
		tensor, various str									
	_	ions, Reynolds trai	-								
			nathematical forms								
		rious fluid motions	•								
		ady, compressible									
111		npressible) Bernou	ional Inviscid Fluid			The stud	lanta	,;11 1	m abarra		
III			ial, Sources, sinks,								
	l .	s: Complex potent lets, images with re		- 1	complex its applic	_			1,		
		e, MilneThomson c		10	- 1	ns appno inviscid			acinig	2,	
		us theorem, motion		10		111 v 1301U	munu 1	10 W 3.		3	
		der, axi-symmetric	-								
		n function.	,								
IV		er-Stokes Equation	s and its Exact		-	The stud	lents w	ill lear	n about		
- '		ions: Navier-Stoke				the Navi				1,	
		ange of circulation	-	10		and their		_		2	
		city, vorticity equat				various 1					

	dissipation due to viscosity, exact solutions of Navier-Stokes equations: Couette flow, Poiseuille flow, Hagen-Poiesuille flow through a pipe, flow through annular region, Stokes firs problem.			
V	Boundary Layer Theory: Laminar boundary layer, two-dimensional boundary layer equations, Blasius equation, boundary layer parameters, separation of boundary layer, momentum and energy integral equation.	15	The students will learn about boundary layer formation, equations, and the conditions leading to separation.	1, 2, 3

- T1. Chatterjee, R. (2015). Mathematical Theory of Continuum Mechanics. Narosa Publishing House.
- T2. Schlichting, H., Gersten, K. (2016). Boundary-layer theory. Springer.
- T3. Chorlton, F. (2004). Textbook of fluid dynamics. CBS Publisher.

#### **REFERENCEBOOKS:**

- R1. Spencer, A. J. M. (2004). Continuum Mechanics. Dover Publications.
- R2. Raisinghania, M. D. (2003). Fluid Dynamics. S. Chand Publications.
- R3. Lamb, S. R. (1945). Hydrodynamics. Dover Publications.
- R4. Ramsay, A. S. (1913). Hydrodynamics (A Treatise on Hydromechanics). G. Bell and Sons, ltd.
- **R5**. Kundu, P.K. Cohen, I. M., Dowling, D. R. (2011). Fluid Mechanics. Academic Press. 6. Thomson, L. M. M. (2011). Theoretical Hydrodynamics. Dover Publications.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Define waves and its basic concepts.	1, 2, 4
2	Describe stress-strain relationship of Newtonian fluids.	1, 2, 3, 4, 7
3	Describe two and three-Dimensional Inviscid Fluid Flows.	1, 2, 3, 4, 8
4	Derive Navier-Stokes equations under different geometries.	1, 2, 3, 4, 7
5	Describe Laminar boundary layer and Blasius equation.	1, 2, 3, 4, 6

			SEMESTE	ER-IV							
Course T	itle		Continuum Mec	hanics an	d Hy	drody	nami	cs			
Course c	ode	24MSMT2202R	Total credits: 3	L	T	P	S	R	O/F		С
			Total hours: 45T	3	0	0	0	0	0		3
Pre-requi	isite	Nil	Co-requisite				N	il			
Program	ıme		Master of S	cience in	Mat	hemati	ics				
Semeste	er		Fall/ III semester o								
Cours			ut the continuum cor		ıchy'	s stress	s princ	ciple, s	stress ten	sor,	,
Objectiv	ves	_	rical stress tensors et								
			Lagrangian and Eule	erian desc	riptio	ons of s	straın,	defori	mation to	enso	rs,
		different forms of s			. ,.	.1	1.	1 .	1.		
			ut motion and its ma	terial deri	ıvatıv	e, path	lines	and st	reamline	es,	
		material surface an	d line elements.  ut the kinematics of	fluida in a		المممسا	Eastan	,, a a f	matian i		
		inviscid fluids.	ut the kinematics of	mulas III I	поис	m and i	Easioi	1 8 01 1	попоп п	11	
			motion in a plane an	d motion	in en	ace A	leo to	under	etand ah	out	
			general theory of irr		•		150, IO	unucl	sunu au	oui	
CO1			nuum concept of stre				rincinl	e. stre	ss tenso	r etc	· · · · · · · · · · · · · · · · · · ·
CO2			l its different type			_	_				
002		descriptions.	ins different type	o togeth	· · ·	1011 011	בשב	51411511	an unu		· CII cui
CO3		_	ate of deformation a	nd Vortic	itv w	ith thei	r phys	sical in	nterpreta	tion	
CO4		Describe motion, rate of deformation and Vorticity with their physical interpretation.  Define the kinematics of fluids in motion and equations of motion of inviscid fluids.									
CO5		Describe motion in a plane and motion in space, Vortex motion and general theory o									
		irrotational motion	•	•							•
Unit-		Conte	nt	Contac	et	Learning Outcome					KL
No.				Hour							
I	An	alysis of stress:	The continuum			Studen	ts wil	l have	an in-		
		cept, homogeneity		depth knowledge stres							
		sity, Cauchy's stre	• •	15		the continuum concept					
		sor, equations of e	-			related to it, Cauchy's					
	qua	dric of Cauchy, pri	ncipal			stress principle etc.					1,2
	G,		1								
		ess, stress invariants									
II	_	erical stress tensors alysis of strain: Lag			$\perp$	Studen	te will	Lunda	retand	+	
11		arian descriptions, of	•			about s					
		sors, finite strain ter		10				_	iptions,		
		formation theory, lin							rs, finite		
		l physical interpretar				strain e		· · · · · · · · · · · · · · · · · · ·	5, 1111100		
		I finite strain interpr									1,2
		dric of Cauchy, prii									
	_	in invariants, spheri	-								
		in components, equ									
	con	npatibility.			_						
III		tion: Material deriv				Studen					
		l stream lines, rate o					_		ion, its		
		rticity with their phy							s, path		1,
		erpretation, material		10		lines a					2
		ume surface and line	· ·			Vortici	-				_
		ume, surface and lin	-			physic	al inte	rpreta	tion.		
		damental laws of co	ntinuum								

	mechanics.			
IV	Kinematics of fluids in motion and equations of motion of inviscid fluids: methods of describing fluid motion, material, local and convective derivatives, path lines, stream lines, vortex lines, equations of continuity, equations of motion and their integrals, boundary conditions, impulsive motions.	15	Students will have knowledge about the kinematics of fluids in motion and equations of motion of inviscid fluids, method of describing fluid motion etc.	1, 2
V	Motion in a plane and motion in space: Use of complex potential, source, sink, doublet, method of images, the circle theorem, the theorem of Blasius, motion past circular cylinder. Vortex motion and general theory of irrotational motion: Vorticity equation, properties of vortex filaments, motion due to rectilinear vortex and a system of vortices, Kelvin's circulation theorem and its use.	10	Students will have knowledge about the motion in a plane and a motion in space together with the concept of Vortex motion and general theory of irrotational motion.	1, 2

- T1. A Treatise on Hydromechanics, part II- W. H. Basant and A. S. Ramsay, CBS Publishers, Delhi.
- T2. Text Book on Fluid Dynamics-Frank Chorlton, CBS Publishers, Delhi.
- T3. Continuum Mechanics, G.E. Mass, Schaum's Outline series, McGraw Hill Co.

#### **REFERENCEBOOKS:**

- R1. An introduction to Fluid Mechanics- G. K. Batchelor, Foundation Books, New Delhi.
- R2. Hydrodynamics-M. D. Raisinghania, S. Chand and Co. Limited.
- R3. Mathematical Theory of Continuum Mechanics-R.Chatterjee, Naroda Publishing House.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the continuum concept of stress, Cauchy's stress principle, stress tensor etc.	1, 2, 4
2	Define strain and its different types together with the Lagrangian and Eulerian descriptions.	1, 2, 3, 4, 8
3	Describe motion, rate of deformation and Vorticity with their physical interpretation.	1, 2, 3, 4, 7
4	Define the kinematics of fluids in motion and equations of motion of inviscid fluids.	1, 2, 3, 4, 8
5	Describe motion in a plane and motion in space, Vortex motion and general theory of irrotational motion.	1, 2, 3, 4, 6.

		SEMESTE	R-IV							
Course T	itle		matical I	Metho	ods					
Course co		Total credits: 3	L	Т	P	S	R	O/F	·	C
							0	0		3
Pre-requi	isite Nil	Co-requisite		I		N	il	1		
Program	me	Master of So	cience in	Math	emati	cs				
Semeste	er	Fall/ III semester of	f first yea	ar of t	the pr	ogran	nme			
Course	e 1. To provide	an overview of inte	gral equ	ation	and de	escrib	e vario	ous ma	then	natical
Objectiv	res methods to solve in	ntegral equations.								
		Laplace transformat								
		Fourier transformati								
	_	olution methodologie	s of wide	range	e of pr	oblem	ıs in pl	nysical	scie	ences
	using calculus of v									
CO1		nation and describe m			ethods	to sol	ve inte	egral ec	luati	ions.
CO2		ransformation and its								
CO3		ansformation and its			- lav '	a1 ~·'	<b></b>	nai	1	.1
CO4	explore the solution variation.	ons of wide range of	problem	ıs ın p	onysic	al SC16	ences	using c	aicu	iius of
CO5		integral equations of	of the e	2005 1	lein A	their	roca1	want 1-	arr -	1 000 4
COS	iterative solution to	•	of the se	econa	KIIIU,	men	resor	veni k	erne	i, and
Unit-	Conte		Contac	·+	Ιω	rnin	a Out	utcome		KL
No.	Conte	SHL	Hour		LC	41 11111	g Out	Conic		KL
I	Integral Equations : De	efinition of	11041		ntrodu	ction	of inte	egral		
_		tegral Equation, Reduction of ordinary fferential equations into integral quations. Fredholm integral equations				ns		8		
	_									1.0
	with separable kernels									1,2
	Eigen functions.									
II	Volterra Integral Equa	tions: Volterra		J	Jnders	tand '	Volter	ra		
	Integral Equations of s	econd kind,			ntegra					
	Resolvent Kernal of V	-	8		Resolv					
	and its results, Applica		Ü		Volteri	a equ	ation a	and its		
	scheme to Volterra equ			r	results					1,2
***	second kind. Convolut	* *				-				
III	Laplace Transform: Ba				Descril	•		·4		
	Laplace Transform, Co				ransfo		on and	IIS		
	theorem and properties Inverse Laplace Trans			6	pplica	шоп				
	of Laplace Transform		10							1,2
	_									1,2
		rdinary and partial differential quations of initial and boundary value								
	problems.									
IV	Fourier Transform: Fo	urier Integral		I	Descril	oe Foi	ırier			
	Transform. Properties	· ·		t	ransfo	rmatio	on and	it's		
	Transform, Fouriersine			a	pplica	tion.				
	transforms, Applicatio	n of Fourier	10							
	transform to ordinary a	_	10							1,2
	differential equations of									
	boundary value proble	ms. Evaluation of								
	definite integrals.		10							
V	Calculus of variation v	Calculus of variation with one				solve	e wide	range		

independent variable: Basic ideas of	of problems in physical	1,2
calculus of variations, Euler's equation	sciences using calculus of	
with fixed boundary of the functional	variation.	
Containing only the first order derivative		
of the only dependent variable with		
respect to one independent variable.		
Variational problems with functional		
having higher order derivatives of the		
only dependent variable, general case of		
Euler's equation, applications.		

- T1. Gupta, A. S. (1996). Calculus of variations with applications. PHI.
- T2. Parashar, B. P. (1994). Differential and Integral Equations. CBS Pub and Distributors.
- T3. Raisinghania, M. D. (2007). Integral equations and boundary value problems. S.Chand.

#### **REFERENCE BOOKS:**

- R1. Hildebrand, F. B. (2012). Methods of applied mathematics. Courier Corporation.
- R2. Spiegel, M. R. (1986). Theory and Problems of Laplace Transform.
- **R3**. Courant, R., Hilbert, D. (2008). Methods of Mathematical Physics: Partial Differential Equations. John Wiley & Sons.

#### OTHER LEARNING RESOURCES:

- 1. http://mathforum.org
- 2. <a href="http://ocw.mit.edu/ocwweb/Mathematics">http://ocw.mit.edu/ocwweb/Mathematics</a>

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Define integral equation and describe mathematical methods to solve integral equations.	1, 2, 4
2	Describe Laplace transformation and its application.	1, 2, 3, 4
3	Describe Fourier transformation and its application.	1, 2, 3, 4, 8
4	Explore the solutions of wide range of problems in physical sciences using calculus of variation.	1, 2, 3, 4, 7
5	Describe Volterra integral equations of the second kind, their resolvent kernel, and iterative solution techniques.	1, 2, 4, 8

			SEMESTE	ER-IV								
Course T	itle		Oper	ation Re	search	1						
Course c	ode	24MSMT2204R	Total credits: 3	L	T	P	S	R	O/F	С		
			Total hours: 45T	3	0	0	0	0	0	3		
Pre-requi	isite	Nil	Co-requisite				N	il				
Program	ıme		Master of Science in Mathematics									
Semest	er		Fall/ III semester o				_					
Cours			and about the basi		_	_		_				
Objectives			graphical solution of	f linear p	rogran	ns in	two v	ariable	es, basic s	solution		
		and basic feasible s										
			bout the solution						_	_		
		. •	plex method, duality				_		•			
			and Transportation p				ematic	cal for	mulation,	finding		
			sible solution and Le				ad far	aalesi	<b></b>	~~~~		
		problem,	and Assignment prob	nem, num	igarian	meu	100 10	r solvi	ng an assi	giiiieiii		
		•	ment problem and S	alecman	nroble	m						
		•	out Queueing Theor		•		nts fi	ındam	ental stru	cture of		
			cogether with introdu				_					
		Two-Person Zero-S					,,					
CO1			concepts of linear	program	ming	and i	ts for	mulati	on togeth	er with		
		graphical solution.	•	1 0	C				C			
CO2		Solve linear programming problems using simplex method, Big-M simplex method and										
		dual simplex method.										
CO3		Find the initial basic fessible solution by Least Cost Method.										
CO4		Define Assignmen	Define Assignment Problem and its mathematical formulation, Hungarian method for									
		solving an assignment problem, unbalanced assignment problem and salesman problem.										
CO5		Describe the Queueing theory and its basic concepts together with Basic of Game theory,										
			some definitions and Two-Person Zero-Sum game.									
Unit-		Conte	nt	Contac		Lea	arning	g Out	come	KL		
No.	T .			Hour		. 1			1 .	1		
I		ear programming: F		10	about	1,						
		ear Programming mution of linear progr		10			ic of l mming			2		
	1	iables, Linear progr			I -	_		_	of linear			
	1	m, basic variables, b				_			ariables.			
		ic feasible solution.	usio serunieri,		P							
II		ution of linear progr	ramming problem	10	S	tuden	ts will	l unde	rstand	1,		
		ng simplex method,	~ ~		si	imple	x metl	nod fo	r solving	2,		
	me	thod, the two-phase	simplex method.		li	near p	orogra	mmin	g	3		
	Du	ality in linear progra	amming problems,									
	1	al simplex method.										
III	1	nsportation Problen		10					about	2,		
		mulation of the Trar	•			_			blems	3		
	_	blem, Finding initia						ion of				
		ution, Least Cost M				_		on pro				
		balanced Transporta	tion Problem,		to	gethe	er with	its so	lution.			
		generacy.	~			. 4						
IV		signment probl		15					rstand	1,		
		ignment problems,	-				_		problem	2,		
	tor	solving an assi	gnment problem,		a	na me	tnod (	of solv	/ing	3		

	Unbalanced Assignment Problem, Travelling Salesman Problem.		Assignment problem like Hungarian method.	
V	Queueing Theory: Basic concepts of Queueing theory, fundamental structure of Queueing system, Operating characteristics of a Queueing system.  Introduction to Game theory, some basic definitions, Two-Person Zero-Sum game.	15	Students will have in-depth knowledge about Queueing theory, it basic concepts, fundamental structure, a brief introduction on Game theory, some basic definitions and concept of Two-Person Zero-Sum game.	1, 2

- T1. Tasha, H. A. (2007), Operations Research: an introduction, Pearson Education, 2007.
- T2. Branson, R., Naadimuthu, G. (1997), Operations Research, Schaum's Outlines.

#### **REFERENCE BOOKS:**

- R1. Sharma, J. K. (2007), Operation Research Theory and Applications, Macmillan India Ltd.
- R2. Raju. N.V.S. (2002), Operations Research, HI-TECH.
- R3. Swarup, K., Gupta, P. K., Mohan, M. (2014), Operation Research, Sharma, S. Chand& Sons.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the basic concepts of linear programming and its	1, 2, 4
1	formulation together with graphical solution.	1, 2, 4
2	Solve linear programming problems using simplex method, Big-M	1, 2, 3, 4
2	simplex method and dual simplex method.	1, 2, 3, 4
3	Find the initial basic feasible solution by Least Cost Method.	1, 2, 3, 4, 8
	Define Assignment Problem and its mathematical formulation,	
4	Hungarian method for solving an assignment problem, unbalanced	1, 2, 3, 4, 7
	assignment problem and salesman problem.	
	Describe the Queueing theory and its basic concepts together with	
5	Basic of Game theory, some definitions and Two-Person Zero-Sum	1, 2, 4, 8
	game.	

			SEMESTER	R-IV									
Course T	itle		Fuzzy s		Systen	18							
Course c	ode	24MSMT2205R	<b>Total credits: 3</b>	L	Т	P	S	R	O/F	С			
			Total hours: 45T	3	0	0	0	0	0	3			
Pre-requ	isite	Nil	Co-requisite				N	il		•			
Program	ıme		Master of Sci	ence in	Math	emati	cs						
Semest	er		Fall/ III semester of	first ye	ar of t	the pr	ogran	ıme					
Course		1. To introduc	e with Fuzzy sets and	explain	unce	rtainty	using	fuzzy	set theor	y.			
<b>Objectives</b>		2. To know Fuzzy number and method of construction of Membership Function.											
		3. To understand Fuzzy relations and its types.											
		4. To understand Fuzzy logic and fuzzy rule-based system.											
		5. To provide solution methodologies of different types real world problems under											
		uncertainty using F			_								
CO1			and explain uncertaint										
CO2		· ·	per and method of con	structio	n of N	1embe	rship	Functi	on.				
CO3			ations and its types.	1									
CO4			c and fuzzy rule-based				, .	-					
CO5	ı		on of real world probl							177			
Unit-		Conte	ent	Conta		Le	arnin	g Out	come	KL			
No.	D	· CE C II		Hou	r	T		1.1	Б				
I		sic of Fuzzy Sets: U	· · · · · · · · · · · · · · · · · · ·						Fuzzy				
	l	konomy of Uncertain			sets a	-		£					
		Concepts of crispness and fuzziness, Fuzzy				uncertainty using fuzzy set theory.							
		et and its representation, α-cut, convex				set the	eory.			1,2			
		uzzy set, basic operations on fuzzy sets, ypes of fuzzy sets, extension principle, torm, t-conorms and their properties.											
II		zzy Arithmetic and I				Knowledge of Fuzzy number and method of							
11		nstruction of Members											
		zzy Numbers, Types	•			consti							
		erval Arithmetic, Ar	10										
		fuzzy numbers, mer			Membership Function.								
	l .	mulation.	nocismp runction										
III	Fu	zzy Relations: Fuzz	v relation, binary			Able to understand Fuzzy							
	l	zy relations, union a	•					d its ty					
		zy relations, project						•	•				
	exte	ensions, fuzzy equiv	alence relation,	10									
	Fuz	zzy compatibility rel	ations, Fuzzy							1.2			
	ord	ering relations, com	positions of fuzzy							1,2			
	rela	ations and their prop	erties.										
IV	l	zzy logic and Fuzzy	•						d Fuzzy				
		fuzzification, classic	• •	10		_		ızzy ru	ıle-				
		proximate reasoning				based	syste	m.		1,2			
		zy inference, fuzzy								1,2			
$\mathbf{V}$		certainty measure an						e diff					
		-	based information,					l-worl	d				
		n-specificity of fuzzy		15		proble			<b>.</b>				
		zy sets, Application	· · · · · · · · · · · · · · · · · · ·				tainty	using	Fuzzy				
		ision making and ot	her real-world			sets.				1,2			
	pro	blems.											

- **T1**. Stanbury P.F., A. Whitaker, S.j. Hall, Principles of Fermentation Technology Publisher: Butterworth-Heinemann.
- T2. Shuler M. L. and F. Kargi: Bioprocess Engineering Basic Voncepts by Publisher Prentice Hall

#### **REFERENCE BOOKS:**

- R1. Prescott and Dunn's Industrial Microbiology, Publisher: GeraldReed: Books
- **R2**. W.Crueger and A. Crueger: Biotechnology. A text book of Industrial Microbiology, Publisher: Sinauer Associates.

#### OTHER LEARNING RESOURCES:

- 1.https://microbenotes.com/
- 2. www.youtube.com.

	CO PO Mapping									
SN	Course Outcome (CO)	Mapped Program Outcome								
1	Explain the principles of diverse bioreactors and their advantages	1, 3								
2	Illustrate different microbial strain improvement strategies and the development of novel applications.	1, 2, 3, 4, 8								
3	Illustrate various fermentation products and the underlying biotechnological principles involved.	1, 2, 3, 4, 7								
4	Describe various downstream processes and their storage and packaging techniques.	1, 2, 3, 4, 8								
5	Explore the potential of using microbes to produce metabolites in industrial settings.	1, 2, 3, 4, 8, 8								



## Assam down town University

## Curriculum and Syllabus

## **Master of Science in Physics**

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM Version: 1.0

### **FACULTY OF SCIENCE**

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the programme

and to be eligible for the degree. This volume also includes the prescribed literature, study

materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Damey

Member Secretary, Academic Council

#### Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

#### Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

#### **Programme Overview**

MSc Physics offers a wide range of courses covering various basic and applied areas of life sciences. The student develops an aptitude and scientific temperament to apply the technical skills in various important areas of physics such as Condensed Matter Physics, Nuclear Physics, Atomic, Molecular spectroscopy & Laser, Astrophysics, General Theory of Relativity & Cosmology, Plasma Physics etc. The course also offers various techno specific skills, universal ethics and elective courses considering overall development and employability scopes in research, industry and teaching sectors. The course duration is for a period of 2 years.

#### I. Specific Features of the Curriculum

The Master of Physics curriculum features core courses typically provides advanced theoretical and practical knowledge in physics and prepares students for research or professional work in various scientific and technical fields. The curriculum often includes a mix of compulsory core courses, elective courses, and hands-on research or project work along with seminars, workshops, and industry or internships. The program incorporates interdisciplinary approaches, regulatory and ethical training, and develops essential soft skills such as scientific communication and project management. Additionally, it offers global perspectives on strong foundation in physics and the necessary skills for pursuing advanced research, teaching, or careers in industries like aerospace, data science, energy, healthcare, and materials science.

#### **Eligibility Criteria:**

The minimum required qualification for the proposed program is Bachelor degree with 50% aggregate marks or equivalent CGPS in Physics/Applied Physics (honours subject) and Mathematics as one of the pass subjects.

#### **II.** Program Educational Objectives (PEOs):

- **PEO-1:** AdtU Physics Postgraduates will be well prepared for successful careers in academic, research, industry and government sector as academician, scientist, quality control & quality assurance officers, geophysists etc.
- **PEO-2:** AdtU Physics Postgraduates will be academically prepared to contribute effectively to the growth and development of applied physics and allied domains
- **PEO-3:** Graduates will be able to communicate effectively, work collaboratively, exhibit professionalism, engage in lifelong learning and a successful entrepreneur.

#### **III.** Program Specific Outcomes (PSOs):

- **PSO-1: Global certification:** Exhibit global competency to excel in the profession.
- **PSO-2: Innovation and Entrepreneurship:** Apply multidisciplinary approach for research exploration and collaboration with professionals across diverse disciplines contributing to innovation and entrepreneurship.
- **PSO-3: Experiential Learning:** Exhibit an in-depth understanding of the concept of physical science and apply interdisciplinary knowledge to address the challenges within the domains of physics and relevant fields.

#### IV. Program Outcome (PO):

- **PO-1: Disciplinary Knowledge:** Apply fundamental principles of basic and applied physics to elucidate various phenomena occurring in the universe.
- **PO-2:** Analytical Skill: Identify and analyze problems, derive solution related to physical phenomenon of molecules, matters, life, society, intrastellar and extrastellar systems to formulate solutions.
- **PO-3: Problem solving and Interpretation:** Identify complex physical problems and analyze them using the various theory and laws of Physics.
- **PO-4: Proficiency:** Proficient in using software such as FORTRAN, MATLAB, SKYLAB, PYTHON for analysis and solving complex problems.
- **PO-5: Communication:** Communicate efficiently with scientific temperament and thoughts with the all stakeholders including peers and beneficiaries.
- **PO-6: Professional ethics:** Apply ethical principles and commit to professional ethics and responsibilities.
- **PO-7: Research:** Exhibit temperament to take up research project on topics related to physics and independently framing relevant questions, designing experiments and interpret the results.
- **PO-8:** Career aptitude: Ability to build a career in different scientific and technological fields by acquiring the adequate knowledge of Physics.

#### V. Total Credits to be Earned: 89

#### **Career Prospects:**

Capable of find better carrier opportunities in research labs, medical labs, academic institutions, IT field, technical field, automobile industry and various government-owned Scientific Research and Development Organizations

M.Sc. Physics graduates after successful completion of their master degree can do research in various field of physics and simultaneously apply for various fellowships offered by different institutes and agencies.

In India, students could get the opportunity to work with Oil and Natural Gas Corporation (ONGC), Oil India Ltd (OIL), Defense Research and Development Organization (DRDO), Bhabha Atomic Research Centre (BARC), Saha Institute of Nuclear Physics Kolkata, Bharat Heavy Electricals Ltd (BHEL), Indian Space Research Organization (ISRO) etc.

Exhibit in-depth practical expertise to students in many thrust areas of Physivs in order to fulfil worldwide industry and academic demands.

The ability to design aids in the development of solutions for complicated problems while taking into account public health and safety, as well as cultural, sociological, and environmental considerations.

#### **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### **INSTRUCTION**

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers:**

The question paper shall follow the principles of Bloom's Taxonomy. Table

S. N.	Level	Questions /verbs for test							
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when,							
1	Kememoer	where, etc.							
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.							
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify							
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.							
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.							
6	Create	Design, Formulate, Modify, Develop, integrate, etc.							

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

 Sl no
 Question pattern
 Total marks

 1
 MCQs (10 Questions)
 10

 2
 2 Marks questions (10 Questions)
 20

 3
 4 Marks questions (5 Questions)
 20

 4
 10 Marks questions (1 Question)
 10

Table 1: Question paper pattern for End semester examination

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voice etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

#### VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test,

the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### **VII.** Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Letter Grade	Grade Points	Description
О	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
С	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

**Table 2: Letter Grades and Grade Points** 

#### iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} C_{i}G_{i}}{\sum_{i=1}^{n} C_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### b. CGPA (Cumulative Grade Point Average)

(i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and

Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words,taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.

(ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

CGPA = 
$$\frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### **D.** Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.

- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct class room teaching through series of lectures delivering concepts using ITC facilities, white or black board. Notes may also be circulated to the students however; the students are to be involved in preparation of the notes. The teacher will be responsible in selecting the best note for circulation. The teacher- centric methodology has recently fallen out of favour because this strategy for teaching is seen to favor passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the student for studying by themselves, prepare presentations, notes etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitate the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behavior problems, teachers must lay a lot of groundwork in student- centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visit to the laboratory for experiments or field and survey. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo a project-Based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watchvideo or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- **d. Cooperative Learning:** The remaining five percent has to be completed by cooperative learning approach. In this approach the students are allotted with problems. During the library hours the student along with the teacher visits library search probable solution for the assigned problem. The same has to be done in group so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social

interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

#### The percentage categorization for the completion of a theory course

Teacher- centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student- centric Approach, Student present and deliver lectures in presence of teacher and supervised by teacher	60%
Student visit fields or perform experiments or teacher perform demonstration Flipped Classroom approach Cooperative learning approach	05% 10% 05%

#### Inquiry based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare lesson plan for execution and maintain a file

#### **Breakdown of Credits**

Sl. No.	Category	Total number of
		Credits
1.	Discipline Specific Core (Major)	19
2.	Discipline Specific Core (Minor)	8
3.	Skill Enhancement Course (SEC)	4
4.	Discipline Specific Elective (DSE)	18
5.	Ability Enhancement Course (AEC)	6
6.	Value Added Course (VAC)	4
7.	Co and extra-Curricular	2
8.	Multidisciplinary Course (MDC)	2
9.	Field Training	2
10.	Research /Industry Internship	20
11.	Summer Internship	4

#### **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	83	93.26%
2	Humanities and Social Sciences	6	6.74%
	Total	89	100%

#### SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course Category	F	Eng	gag	gen	ner	ıt		N.			
	17.				L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSPH1101R	Quantum Mechanics	DSC Major	4	0	0	0	0	0	4	40	60	0	100
·I	2	24MSPH1102R	Classical Mechanics	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
ster	3	24MSPH1103R	Electrodynamics	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Semester I	4	24UMFS1101R	Fundamental of Statistics	MDC	2	0	0	0	0	0	2	40	60	0	100
	5	24UMPD1101R	Effective Communication (PDP)	AEC	0	0	4	0	0	0	2	50	0	50	100
	6	24UMEC1101	Extra-curricular	Co and Extra- curricular	0	0	0		0	0	1	0	0	100	100
		Tota	1								17				800
	S.			Course Category	I	- Cnc	790	, en	ner	ıt		Maximum			
	No.	Course Code	Course Title		Engagement								or		
	110.				L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSPH1201R	Mathematical Physics	DSC Major	4	0	0	0	0	0	4	40	60	0	100
	2	24MSPH1202R	Thermodynamics & Statistical Physics	DSC Major	4	0	0	0	0	0	4	40	60	0	100
	3	24MSPH1203R	Electronics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
П	4	24UMPD1201R	Advanced Communication	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester II	5	24MSPH1204R	Post Graduate Practice Teaching	SEC	1	0	0	0	0	0	1	0	0	100	100
Se	6	24MSPH1205R	Research Methodology and Statistical Analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using MS Excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSPH1206R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100
	9	24UMCC1201	Co-curricular	Co and extra Curricular	0	0	0	0	0	0	1	0	0	100	100
		Tota	1								22				1100

	S. N.	Course Code	Course Title	Course Category	I	Eng	gag	en	nen	ıt			laximu Iarks f					
	14.				L	T	P	S	R	0	C	IA*	SEE*	PE*	Total			
	1.	24MSPH2101R	Atomic and Molecular Physics	DSC Major	2	0	2	0	0	0	3	40	60	100	200			
	2	24UMPD2101R	(PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100			
	3	24MSPH2102R	Internship	Internship	0	0	0	0	0	32	4	0	0	100	100			
	4	24MSPH2103R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100			
Semester III	5	24MSPH2104R	Research Project I	Research/ Industry Internship	0	0	8	0	0	0	4	0	0	100	100			
Semes	6	24MSPH2105R	Indian Knowledge System	VAC	0	0		0	0	0	2	0	0	100	100			
			1 1	Elective (Any three														
		24MSPH2106R	Nuclear Physics I	DSE	3	0	2	0	0	0	4	40	60	100	200			
		24MSPH2107R	Condensed Matter Physics	DSE	3	0	2	0	0	0	4	40	60	100	200			
		24MSPH2108R	Astrophysics	DSE	4	0		0	0	0	4	40	60	0	100			
		24MSPH2109R	Plasma Physics I	DSE	4	0	0	0	0	0	4	40	60	100	100			
		24MSPH2110R	Non Linear Optics	DSE	4	0	0	0	0	0	4	40	60	100	100			
		Tota	1								28							
	S.	Course Code		Course Category		Enga			Engagement				t			laximum larks for		
	No.		Course Title		L	T	P	S	R	O	C	IA*	SEE*	PE*	Total			
-	1.	24MSPH2201R	Research Project II	Research/Industry Internship	0	0	32	0	0	0	16	0	0	100	100			
		Ι	Discipline specific	Elective (Any two	su	bje	cts	to	be	sel	ect	ed)						
	3	24MSPH2202R	Nuclear Physics II	DSE	2	0	2	0	0	0	3	40	60	100	200			
Semester IV	4	24MSPH2203R	Advanced Condensed Matter Physics	DSE	2	0	2	0	0	0	3	40	60	100	200			
Sem	5	24MSPH2204R	General Theory of Relativity & Cosmology	DSE	3	0	0	0	0	0	3	40	60	0	100			
	6	24MSPH2205R	Plasma Physics II	DSE	3	0	0	0	0	0	3	40	60	0	100			
	7	24MSPH2206R	Advanced Molecular Spectroscopy & laser	DSE	2	0	2	0	0	0	3	40	60	100	200			
			Total								22							
	Total 89																	

*IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEMESSTE	R I							
Cours	se Title		Quant	um Me	chanic	cs					
Cours	se Code	24MSPH1104R	Total credits: 4		L	T	P	S	R	O/F	С
			Total hours: 60T		4	0	0	0	0	0	4
	equisite	Nil	Co-requisite		Nil						
	equisite	Nil									
	ammes	_	Master of			•					
	ester		Fall/I Semester of F					amn	1e		
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Obje	ectives	2. To develop a of quantum n	and use critical think	ing and	proble	em s	OIVII	ig ski	118 1111	ougn in	e use
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		4. Verify the In	distinguishable and	identical	l partio	cles	in qu	antu	m me	chanics	
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		and applicati									
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Desci	ription	_	and the wave-particl					_			
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Unit-		Content		СН	Le	arni	ing C	Outco	me	KL	Ref
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I		rinciples of quantum					_	on th			T1
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		nger wave equation						he w			
		2-, and 3-dimension		_	1 ^		dual	ity of	-	1.2	
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		tion of quantum mec									
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motion and its physical equivalence with

Symmetry and invariance principle and

Schrödinger equation

conservation

To learn about

symmetry and

10

1,2

**T1** 

	Space and time translations, rotational invariance under infinitesimal and finite rotations. Angular momentum operators, ladder operators, addition of angular momenta – Clebsch-Gordan coefficients	10	invariance principle	1,2	
IV	Pauli spin matrices and SU(2) group, identical particles, symmetric and antisymmetric wave functions, combination of wave functions for a system of particles, spin statistics connection, exchange symmetry and exchange degeneracy.	8	Knowledge on Pauli spin matrices.	1,2	T1, R2
V	Approximation methods in quantum mechanics Time independent perturbation theory, Stark and Zeeman effects, variational method and its applications, WKB approximation, time dependent perturbation theory, transition to continuum states, Fermi's Golden rule, adiabatic and sudden approximation.	10	Concept on approximation methods in QM	1,2	T1

#### **TEXTBOOKS:**

T1: Modern Quantum Mechanics: J.J. Sakurai (Addison Wesley, Reading), 2004.

#### **REFERENCE BOOKS:**

- R1: A Ghatak, S Loaknathan, Quantum Mechanics, Laxmi Publications, 2017.
- R2: Quantum Physics: S. Gasiorowicz (Wiley, New York), 3rd ed. 2003.
- R3: A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan (Tata McGrawn Hill, New Delhi) 2nd edition, 2004.

#### OTHER LEARNING RESOURCES:

1. https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/pages/video-lectures/part-1/

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Identify the concept of quantum mechanics and its statistical interpretation	1,3						
2	Describe the properties of state vectors and Heisenberg's uncertainty principle	1, 3, 4, 7						
3	Define Symmetry and invariance principle and angular momentum	1, 2, 3, 4, 8						
4	Verify the Indistinguishable and identical particles in quantum mechanics	1, 2, 3, 8						
5	Describe the Approximation methods in quantum mechanics, different theories and applications	1, 3, 4, 8						

		SEMESSTER I							
Course Title		Classical Mec	hanic	S					
Course Code	24MSPH1103R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 45T+30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite	Nil						
Anti-requisite	Nil								
Programmes		Master of Science	in Ph	ysics	5				
Semester		Fall/ I semester of first year	r of th	e pr	ogra	mm	ıe		
Course	1. To make st	1. To make students understand the fundamental concepts of the Special Theory							
Objectives	of Relativity.								
	2. To understa	2. To understand the relativistic effects on motion, energy, and momentum.							
	3. To provide the advanced understanding of classical mechanics such as								
	Reference frame, I	agrange's and Hamilton's eq	uation	ıs, ce	ntral	for	ce mo	otion, and	rigid
	body dynamics.								
Course	1. Identify the	concept of reference frames	and t	heir 1	ole i	n de	escrib	ing physic	cal
Outcomes	phenomena.								
	2. Describe th	e postulates of the Special T	heory	of R	elativ	vity			
	3. Define the	concepts of central force mo-	tion.						
	4. Describe th	e idea of rigid body dynamic	es						
	5. Define Pois	sson brackets and their prope	rties						
Course	Classical Mechanic	es involves the study of Lagr	angia	n and	Han	nilto	onian	dynamics	,
Description	central force motion	n, rigid body dynamics and	theory	of sı	nall (	osci	illatio	n.	

Other learning resources <a href="https://www.sciencedirect.com/topics/physics/classical-mechanics">https://www.sciencedirect.com/topics/physics/classical-mechanics</a>

Unit-No.	Content	CH	Learning Outcome	KL	Re
					f
I	Reference frame, Galilean Transformation, postulates of special theory of relativity, Lorentz transformation, acceleration transformation, momentum and energy transformation, time-dilation, lengthcontraction & twinparadox.	7	Knowledge of frames of reference their role in describing physical phenomena	1,2	T1
II	Lagrangian and Hamiltonian formalisms and equations of motion-their applications to physical problems. Cyclic coordinates, relativistic form of Lagrangian and Hamiltonian.	10	To learn the basic of Lagrangian and Hamiltonian theory to know about relativistic mechanics	1,2	T1 , R1
III	Central-force motion - Two-body collisions, scattering in laboratory and centre-of-mass frames.  Variational principle, Symmetry, invariance and conservation laws	10	To understand the basics of Central force motion.	1,2	T1
IV	Rigid body dynamics, moment of inertia tensor, non-inertial frames and pseudo forces. Principal axes and principal moments of inertia. Euler's equation of motion. Symmetric top motion and Foucault's pendulum.	8	To know about the rigid body dynamics	1,2	T1 , R2
V	Poisson brackets and their properties,		Knowledge of		T1

	Theory of canonical transformations and generating function. Hamilton's equation in terms of Poisson bracket, Jacobi identity. Theory of small oscillations, coupled oscillations,	10	Hamilton's equations of motion to interpret the physical meaning of classical mechanics.	1,2	
	diatomic and triatomic molecules.				
Practical	1. To determine the Moment of		Describe, illustrate and		R1
	Inertia of a Flywheel.	30	explain and apply	1,2,	
	2. To determine the value of g		staining techniques and	3,	
	using Bar Pendulum.		carry out microscopic		
	3. To determine the value of g		examination.		
	using Katers Pendulum.				

#### **Text Books**

T1: Classical Mechanics, H. Goldstein (Pearson Education, 2014).

#### **Reference Books**

R1: Classical Mechanics, N. C. Rana and P. S. Jaog (McGraw-Hill, 1991).

R2: Mechanics, L. D. Landau and E. M. Lifshitz (3rd Ed., Pergamon, 1976).

R3: Introduction Classical Mechanics, R. G. Takawale & P. S. Puranik

## OTHER LEARNING RESOURCES:

1. <a href="https://www.sciencedirect.com/topics/physics/classical-mechanics">https://www.sciencedirect.com/topics/physics/classical-mechanics</a>

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Identify the concept of reference frames and their role in describing physical phenomena.	1, 3
2	Describe the postulates of the Special Theory of Relativity	1, 3, 4, 7
3	Define the concepts of central force motion.	1, 2, 3, 4, 8
4	Define Poisson brackets and their properties	1, 2, 3, 8
5	Describe the idea of rigid body dynamics	1, 3, 4, 8

		SEM	ESSTE	RI		·				
Course Ti	tle		Elec	trodynar	nics					
Course Co	de 24MSPH1101R	Total cred	lits: 4		LT	P	S	R	O/F	C
		Total hour	rs: 45T-	+30P	3 0	2	0	0	0	4
Pre-requis	ite Nil	Co-requisi	ite		Nil		•			
Anti-	Nil									
requisite										
Programm	ies	Ma	aster of	Science i	in Phys	ics				
Semester	•	Fall/ I semester of first year of the programme								
Course	1. Student w	1. Student will be able to learn about field lines, flux and electromagnetism.								
Objective	es 2. Student w	ill be able to d	lifferent	iate between	een Loi	entz ga	auge a	ınd co	oulomb g	gauge
	transformations.									
	3. Student v	ill be able to s	olve bo	undary va	lue pro	blems	by ap	plying	g various	S
	boundary conditi	ons.								
Course	1.Describe the ki	nowledge of el	ectrosta	tic and ma	agnetos	tatic aı	nd the	ir app	lication	
Outcome		_			_	e boun	dary o	condit	ions.	
	3.Identify the wa	-	_		on.					
	4. Define the idea	_								
	5. Verify the known									
Course	This subject teac	•	_	_		ynami	es and	l their	applica	tions
Description										
Other lear	ning: https://www.britar	nnica.com/scie	nce/elec	trodynam	<u>nics</u>					
Unit-No.	Content		СН		arning				KL	Ref
I	Review of Electrostat	ics and	15	Able to	describ	e, illus	strate			T1
	magneto-statics: Elect	rostatic and		and exp	olain the	;				
	magnetostatic fields in	n matter.		electros	statics.				1.2	

Unit-No.	Content	СН	Learning Outcome	KL	Ref
I	Review of Electrostatics and	15	Able to describe, illustrate		T1
	magneto-statics: Electrostatic and		and explain the		
	magnetostatic fields in matter,		electrostatics,	1,2	
	Method of images, boundary		magnetostatics and their		
	value problems, Laplace equation		application.		
	in rectangular, cylindrical and				
	spherical coordinates.				
П	Gauge transformation, Coulomb	10	Able to describe, illustrate		T1,
	and Lorentz gauges, Maxwell's		and explain the Gauge	1,2	R1
	equations, conservation of energy		transformation and its		
	and momentum in		applications.		
	electrodynamics, Poynting				
	Theorem.				
III	Wave equation, reflection,	10	Able to describe, illustrate		T1
	refraction and propagation of		and explain the wave	1,2	
	electromagnetic waves in		equation and their		
	dispersive media, wave equation		propagation		
	in a conducting medium.				
IV	Wave-guides and cavity	10	Able to describe, illustrate		T1,
	resonance, EM wave propagation		and explain the wave	1,2	R2
	of various types of EM modes		propagation		
	indifferent types of wave guides.				
V	Retarded potential, radiation from	15	Able to describe, illustrate		T1
	oscillatory dipole, radiation fields,		and explain the charge and	1,2	
	radiation from a point charge in		their properties.		
	motion, Lienard – Wiechart				
	potential, fields of a point charge				
	in motion, power radiated by a				

	point charge, Larmor formula.				
Practical	1. Investigation of a series	15	Able to use various		R1
	resonant LCR circuit		instruments for analysis		
	a. To draw the resonance curve			1,2,	
	and			3,4	
	b. To determine Q factor.				
	2. Hall effect: To calculate the				
	Hall coefficient and the carrier				
	concentration of the sample				
	material.				
	3. Determination of E.M.F. of a				
	cell by using a potentiometer and				
	cell of known E.M.F.				

#### **Text Books**

T1: Introduction to Electrodynamics, David J. Griffiths, Cambridge University Press.

## **Reference Books**

- R1. Satya Prakash. Electromagnetic Theory and Eletrodynamics. 1st edition, Kedar Nath Ram Nath Publisher.
- R2. Edward Mills Purcell. Electricity and Magnetism, 3rd, 2013
- R3. Melvin Schwartz, Principles of Electrodynamics, Dover Publications

## OTHER LEARNING RESOURCES:

1. https://www.britannica.com/science/electrodynamics

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe the knowledge of electrostatic and magnetostatic and their application	1,3						
2	Describe the Maxwell's equations and electromagnetic boundary conditions.	1, 3, 4, 7						
3	Identify the wave equation and their propagation.	1, 2, 3, 4, 8						
4	Define the idea of electromagnetic radiation.	1, 2, 3, 8						
5	Verify the knowledge of retarded potential and its applications.	1, 3, 4, 8						

		SEMESSTER	I								
Course Title		Fundament	tal of S	tatistics							
Course code	23UMFS111R	Total credits: 3		L	T	P	S	R	O/F	C	
		Total hours: 30T+30P		2	0	2	0	0	0	3	
Pre-requisite	Nil	Co-requisite		Nil							
Anti- requisite	Nil										
Programmes		Master of Science	ce in B	iotechno	logy						
Semester		Fall/I Semester of Firs	t Year	of the P	rogr	amn	ie				
Course	1. Help to ur	nderstand the role of sta	tistics	in data a	nalys	sis, d	ecisio	on-m	aking,	and	
objectives	scientific research										
		students to descriptive				_					
	,	median, mode) and mean	sures o	f dispers	ion (	range	e, vai	riance	e, stan	dard	
	deviation).							_			
		Teach students how to summarize and present data effectively using tables,									
	charts, and graphs										
CO1	*	nderstanding of Descript									
CO2	_	ge to understand the Prol	bability	theory,	Distr	ıbuti	on, ai	nd sa	mpling	3	
GO2	methods.	. 1 . 1.1	1 1 0	1 .1				1 D:			
CO3		ge to understand the met	hods to	or hypoth	esis 1	estin	g and	l B10	logica	l	
604	data analysis.	4 1	1	· C			1	1	. C 1.	4 -	
CO4	_	ge to understand the prin			s stai	istica	il ana	ilyses	s of da	ta.	
CO5	-	ge on R language for dat			·~ O	4			1/1		
Unit-No.	Content	<b>ds</b> : Definition and	СН	Learnin				11	KL		
I				Foundat					$g \mid I$	,2	
	_	, concepts of statistical mple. Data: quantitative		of Stati	stica	I COI	cepis	S			
	^ ^	tributes, variables,	5								
	_	ment nominal, ordinal,									
	interval and ratio.	inom nominal, oramai,									
II		ular and graphical,		Proficie	ncv i	n Da	ta		1	,2	
	including histogra			Presenta	•			vsis		,_	
	Measures of Centr							,			
		positional. Measures of	_								
		, quartile deviation,	5								
	mean deviation, st	andard deviation,									
	coefficient of vari	ation, skewness and									
	kurtosis.										
III	Bivariate data: D	efinition, scatter		Knowle	dge (	on A	nalyz	zing	1	,2	
	diagram, simple, p	partial and multiple		Bivariat	e Da	ta an	d				
	correlation (3 vari	• /	5	Relation	iship	S					
	_	e linear regression,									
		ials and exponential									
	curves.									_	
IV	· •	nent: trial, sample point		Underst		_			1	,2	
		event, Operations of		Probabi Distribu	-						
	_	of mutually exclusive			tions	8					
		ents. Definition of	8								
	probability: classic										
		ch. Discrete probability									
	space, Properties	•									
	maependence of e	events, Conditional	<u> </u>								

	1 1 1 1 1		I	
	probability, total and compound			
	probability rules, Normal probability			
	Distribution, Bionomial probability			
	Distribution, Poisson Probability			
	Distribution, Bayes' theorem and its			
	applications.			
V	Testing of hypothesis, parametric test: t-		Application of Hypothesis	1,2
	test, z-test, chi-square test. Non-		Testing and Statistical Tests	
	Parametric test: One sample Kolmogorov	7		
	test, wilcoxon Signed test, Mann-			
	Whitney Test, Kruskal walis test.			
Practical	1.Introduction to R - A programming		A brief knowledge on using	1,2,
Tractical	language and environment for data			
			R for data analysis and	3,4
	analysis and graphics. Syntax of R		visualization	
	expressions: Vectors and assignment,			
	vector arithmetic, generating regular			
	sequence, logical vector, character			
	vectors, Index vectors; selecting and			
	modifying subsets of dataset			
	2.Data objects: Basic data objects,			
	matrices, partition of matrices, arrays,			
	lists, creating and using these objects;			
	Functions- Elementary functions and			
	summary functions, applying functions to			
	subsets of data. Data frames: The benefits			
	of data frames, creating data frames,			
	combining data frames, Adding new			
	classes of variables to data frames; Data			
	frame attributes.			
	3.Importing data files: import. data	30		
	function, read. table function; Exporting			
	data: export. data function, cat, write, and			
	write. table functions, function,			
	formatting output - options, and format			
	functions; Exporting graphs -export.			
	graph function. Graphics in R: creating			
	graphs using plot function, box plot,			
	histogram, line plot, steam and leaf plot,			
	pie chart, bar chart, multiple plot layout,			
	plot titles, formatting plot axes;			
	Visualizing the multivariate data: Scatter			
	plot, Q-Q plot, P-plot.			
	4.Performing data analysis tasks:			
	Reading data with scan function,			
	exploring data using graphical tools,			
	computing descriptive statistics, one			
	sample tests, two sample tests, Goodness			
	of fit tests.			
	5. Parametric test and Non-Parametric test			
	3.1 arametric test and non-parametric test			

T1. Methods in Biostatistics by K S Negi, ISBN:9789374735053,4th Edition, Year:2023, AITBS Publishers, INDIA **Reference books** 

R1."Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig R2. "Statistics" by David Freedman, Robert Pisani, and Roger Purves

# OTHER LEARNING RESOURCES:

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Improve understanding of Descriptive Statistics and Demography.	1, 4						
2	Develop knowledge to understand the Probability theory, Distribution, and sampling methods.	1, 4						
3	Develop knowledge to understand the methods for hypothesis testing and Biological data analysis.	1,4						
4	Develop knowledge to understand the principles of various statistical analyses of data.	1,4						
5	Develop knowledge on R language for data analysis	1, 4, 9						

		SEMESTER -	I						
Course Title	F	FFECTIVE COMMUN	ICAT	ION					
Course Code	24UMPD1101R	Total credits: 2	L	T	P	S	R	O/F	C
		Total hours: 60P	0	0	4	0	0	0	2
Pre-requisite	Nil	Co-requisite				Nil		•	
Programmes		Master of Scien	ce in I	Biotech	nology				
Semester		Fall/I Semester of Firs	st Year	r of the	Progra	amme			
Course		the types of sentences and		_					
Objectives		n the students' vocabulary				_		_	
		e the students with the im						_	ons.
		he3P's (Planning, prioritiz	_	-			_		
	1	ht into English pronunciat		d into	central o	concep	ts in pho	onetics.	
CO1		the different types of sent							
CO2		skills of reading and speak					nication		
CO3	•	tte sessions will boost the			and mo	rals.			
CO4		fective and efficient utilization							
CO5	Explain the concept of	of Phonetics and its import	ance v	vill imp	rove th	e learn	ers 'pro	nunciatio	n
MODULES	Module 1- Gramma	r							
	Interchange of Inter	rogative and Assertive S	entend	es, Ex	clamato	ory and	d Asser	tive Sent	tences,
	Types of Tenses, Cor	nmon Errors, Synonyms, 2	Anton	yms, H	omonyı	ns			
	Module 2- Reading								
		etive Reading, Gathering	ideas	and i	nforma	tion fr	om a t	ext The	SQ3R
	Technique Interpret t								
	Module 3-Listening								
		he Process of Listening, 1				•		-	
	_	d Hearing, Purpose and In	mporta	ince of	Effecti	ve List	ening, F	low to In	nprove
	Listening Process,								
	Module 4- Conflict	_							
		Conflict Management, Effe	ects of	Confli	et Mana	gemen	t, Meth	ods to dea	al with
	Conflicts (Negative)								
	Module 5- Time-Ma	O			_				
		e Management, Purpose A	And In	nportan	ce of T	ime M	anagem	ent, Basi	c Tips
	to Maintain Time.								
	=	olving activity: A situation		_	en to th	e stude	ents and	they wil	l have
TENTROOMS	to tell us how to hand	le the situation or solve th	e prob	lem.					

#### **TEXTBOOKS:**

- T1. Wren, P.C and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
- T2. English Grammar in Use, Raymond Murphy 4th edition, CUP.
- T3. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

#### **REFERENCE BOOKS:**

- R1. English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- R2. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Analyse and identify the different types of sentences.	1,5
2	Able to integrate the skills of reading and speaking in professional communication.	1, 5, 9
3	Illustrate code Etiquette sessions will boost their confidence and morals.	5, 6, 9
4	Describe about the effective and efficient utilization of time.	5,9
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	1, 5, 9

		SEMESTER – II							
<b>Course Title</b>		Mathematical Phys	ics						
Course code	24MSPH1102R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 60T	4	0	0	0	0	0	4
Pre-requisite	Nil	Co-requisite	Nil						
Anti- requisite	Nil								
Programmes		Master of Science in P	hysic	es					
Semester		Fall/I Semester of First Year o	f the	Prog	gram				
Course	1. To underst	and and apply the mathematical sk	ills to	o solv	e qua	antita	tive j	proble	ms
objectives	in the study of phy	ysics							
	2. To impart	2. To impart knowledge about various mathematical theory which will enable the							
	students to unders	tand the physics problem.							
	3. Students c	an use differential and integral equ	uatio	ns as	a too	l to a	naly	ze	
	experimental data								
Course	1. Describe to	he linear vector space and matrices.							
outcomes:	2. Verify the	fundamentals of matrices and tensor	ors fo	or sol	ving 1	nore	com	plex	
	mathematical exp	ressions							
	3. Identify th	e concepts of differential and integr	ral ec	quatic	n to	solve	mat	hemati	ical
	problems in physi	cs							
	4. Describe t	he concepts of complex variables.							
	5. Define the	concepts of group theory.							
Course	This paper is inter	nded for students to impart knowle	dge o	on in	trodu	ction	to th	ne stud	ly of
Description:	mathematical phy	rsics by knowing the concepts of	vecto	r spa	ce ar	ıd ma	atrice	es, ten	sors,
	differential and in	tegral equation, complex variables	and g	group	theo	ry.			

# Other learning resources:

Unit-No.	Content	CH	Learning Outcome	KL	Ref
I	N-dimensional linear vector space,	10	Knowledge on the concept	1,2	T1
	basis, scalar product, metric spaces.		of scalars and vectors their		
	Infinite dimensional space – Hilbert		multiplication and matrix		
	space. Matrix representation of		representation.		
	operators, Unitary and Hermitian				
	matrices. Diagonalisation of				
	matrices, eigen values and eigen				
	vectors.				
II	Contravariant and covariant tensors.	10	Understanding the tensors		T1,
	Outer product and contraction.		and their applications.	1,2	R1
	Kronecker delta and Levi Civita				
	tensor.				
III	Hermite and Legendre polynomials.	10	Build knowledge of the	1,2	T1
	Gamma and beta functions. Dirac		different differential and		
	functions. Partial differential		integral equation and their		
	equations: One dimensional wave		solution.		
	equation, one dimensional heat flow				
	equation (finite and infinite rod).				
	Laplace's equation and its solution.				
	Green's function. Fredholm and				
	Volterra types. Method of				
	substitution.				

IV	Analyticity, Cauchy integral theorem, residue theorem and complex integrations.	8	Understand the complex variables and their theory.	1,2,	T1, R2, R1,
V	Introduction to groups, subgroups, coset, classes and factor groups. Direct and semi-direct products. Group representation: reducible and irreducible representation.	7	Learn the concepts of group theory and their representation.	1,2, 3, 4	T1

## **TEXTBOOKS**

T1. Satya Prakash, Mathematical Physics.

#### REFERENCE BOOKS

R1. Mathematical Physics, V. Balakrishnan (1st Ed., Ane Books, 2018).

R2. B. D. Gupta, Mathematical Physics.

R3. Mathematical Methods for Physicists, G. Arfken (7th Ed., Elsevier, 2012).

# OTHER LEARNING RESOURCES:

https://web.mit.edu/8.Math/www/lectures/index.html

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe the linear vector space and matrices.	1						
2	Verify the fundamentals of matrices and tensors for solving more complex mathematical expressions	1, 2, 3, 4, 6						
3	Identify the concepts of differential and integral equation to solve mathematical problems in physics	1, 2, 3, 4, 6						
4	Describe the concepts of complex variables.	1, 4						
5	Define the concepts of group theory.	1, 2, 7						

			SEME	STER	l – II						
Cour	se Title		Thermodyna	amics	and S	tatistica	al Mec	hani	es		
Cour	se code	24MSPH1202	Total credits: 4	L	T	P	S	R	O/F	C	
		R	Total hours: 60T	4	0	0	0	0	0	4	
	equisite	Nil	Co-requisite					Nil			
	rammes					e in Ph	•				
	nester		Spring/II Semes								
	ourse		tand thermodynamic lav	vs, pot	tentials	s, statist	ical ens	semb	les, and	phase trans	itions in
obje	ectives	classical and qu	•			α .			1		. 1
			statistical mechanics to a	ınalyz	e gases	s, fluctu	ations,	and	critical p	henomena	ın real
		world systems.		1:	D	T:4-:	1 .	4:	E	.:	. 1 1-11-
		2. Explore body radiation.	e quantum statistics, incl	uaing	Bose-	Einsteir	i conde	nsau	on, Fern	ni gases, an	id black
-	CO1		modynamic laws, poten	tials	etatieti	cal ence	mbles	and	nhase tro	encitions in	
	.01	classical and qu	•	mais,	statisti	cai ciisc	mores,	anu	phase tra	11151110115 111	
	CO2		l mechanics to analyze g	rases	fluctua	ntions a	nd criti	ical r	henome	na in real v	vorld
	.02	systems.	i incondinos to unaryzo g	, ases,	114014	,	114 0110	rour p		na m rear v	, orra
(	CO3		n statistics, including B	ose-E	instein	conden	sation.	Fern	ni gases.	and black	body
		radiation.	,82				,		,د-۰۰		J
Uni	it-No.		Content		СН		Lear	ning	Outcor	ne	KL
I	Unit-1	: Thermodynami	ic variables, Thermal			Und				mic laws,	
	equili	brium; Temperatı	ure; Zeroth law of			] 1	potentia	als, p	rocesses	s, and	
	therm	odynamics; First	law of				e	effici	encies.		
	therm	odynamics; Seco	nd law of								
		odynamics; Entro	= -								
			of a thermodynamic		7						1,2
			e energy; Enthalpy;								
		free energy; Max									
		ical potential; Th									
		-	istatic and reversible								
			ty. Carnot engine.			***				•.•	
II		nodynamic descri				l .		-	nase tran		
	Clause		of phase coexistence;			K1		-	, and sta	tisticai	
			n der Waal's equation				1	шесі	iames.		
	_	-	Random walk. Kinetic		10						1,2
	theory	=	Random wark. Rinetic		10						1,2
	,		Distribution function;								
	_	_	eneralised equipartition								
	theore		1 1								1
III			oltzmann entropy;			Und	erstand	stati	stical en	sembles,	†
			nical ensemble; Ideal							ons, and	1
	classic	cal gas; Gibbs par	radox; Canonical						ynamics		
	ensem	ıble; Canonical p	artition function; Free						-		
	energ	y; grand-canonica	al ensembles, partition		10						1.2
		=	of classical statistical					1,2			
			of thermodynamics								
			nics principles, equation								1
		e for ideal and re	al gases, Gibbs								1
	parado										
IV		-	n statistics, quantum					_	antum st		1
		anical ensembles,				er	semble		d proper	rties of	1
		_	anonical ensembles,		8			ga	ses.		1,2
	=	_	statistical mechanics.		-						
			Bose–Einstein and								1
	Fermi	–Dirac statistics,	partition and grand			<u> </u>					1

	partition functions, statistics of occupation numbers, distinction between classical and quantum statistics, fluctuations. Ideal Bose gas and its properties, Bose-Einstein condensation (BEC) and experimental evidences, thermodynamics of black body radiation. Ideal Fermi gas and its properties, degenerate and nondegenerate  Fermi gas, electrons in metals, white dwarfs.			
V	Fluctuations, Brownian motion, Einstein– Smoluchowski theory, Langevin theory, approach to equilibrium: Fokker-Planck equation. Critical Phenomena, Phase transitions, Ising model, Yang and Lee Theory. Properties of Liquid Helium, Two fluid hydrodynamics, Landau criterion, Theory of Feynman.	10	Understand fluctuations, critical phenomena and phase transitions.	1,2

## **TEXTBOOKS**

T1. T1: Statistical Mechanics: R.K. Pathria and P.D. Beale.

# REFERENCE BOOKS

R1. Statistical Mechanics: K. Huang.

R2. Callen, H. B., Thermodynamics and Introduction to Thermostatistics, 2nd edition, (Wiley Student Edition).

R3. Statistical Physics: L. Landau and E.M. LifShitz.

## OTHER LEARNING RESOURCES:

https://ocw.mit.edu/courses/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/video galleries/video-lectures/

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Understand thermodynamic laws, potentials, statistical ensembles, and phase transitions in classical and quantum systems.	1, 2						
2	Apply statistical mechanics to analyze gases, fluctuations, and critical phenomena in real world systems.	1, 3, 4						
3	Explore quantum statistics, including Bose-Einstein condensation, Fermi gases, and black body radiation.	1, 2, 3, 4						

		SEMESTER – II							
<b>Course Title</b>	Electronics								
Course code	24MSPH1204R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 45T+30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite					Nil		
Programmes		Master of Science i	n Phy	sics					
Semester	Sp	ring/II Semester of First Yea	ar of t	he P	rogi	ramr	ne		
Course	1. To get the con	ncept of various semiconductor	or dev	rices	such	as d	liode	s and	
objectives	transistors, LED and	solar cell							
	2. Students will	learn the basic concepts of O	p-Am	p an	d the	eir ap	plica	itions	
	3. A basic idea	on digital circuits, both sequen	ntial a	nd c	omb	inatio	onal	circuits	
Course	1. Describe vari	ous semiconductor devices su	ıch as	diod	les a	nd tr	ansis	tors	
Outcomes	2. Identify operation	ational Amplifier and its appli	cation	ıs.					
	3. Define the bu	ilding blocks of digital syster	ns and	d con	nbin	ation	al ci	rcuits.	
	4. Identify the b	asic concept of memory elem	ents a	nd s	eque	ntial	circu	iits.	
	5. Describe basic concepts of combination of logic gates								
Course	Through the electronics course, students will the knowledge on semiconductor devices								
Description	such as Diodes, Zer	er diode as voltage regulator,	, trans	istor	s, So	olar (	Cell,	Photodo	etectors,
	LED etc. they will le	arn about amplifier logic gate	s and	their	des	igns.			

Other learning resources: <a href="https://www.youtube.com/watch?v=w8Dq8blTmSA">https://www.youtube.com/watch?v=w8Dq8blTmSA</a>

Unit-	Content	СН	Learning Outcome	KL	REF
No.					
I	Semiconductor devices: Diodes, Zener	7	Knowledge on		T1
	diode as voltage regulator, transistors,		semiconductor devices		
	transistor biasing and deloadline		and its applications	1,2	
	analysis, Introduction to Optoelectronic				
	devices, Solar Cell, Photodetectors,				
	LED etc. Concepts of FET Devices:				
	JFET, MOSFET, MESFET etc.				
II	Typical operational amplifier,	6	Knowledge on	1,2	T1,
	differential amplifier, differential mode		amplifiers and its types.		R1
	& common mode operation, CMRR,				
	Open loop and close loop Op-Amp,				
	application of inverting &noninverting				
	amplifier, voltage follower.				
III	Logic gates, Design of Half and Full	7	Knowledge on different		T1
	Adders, Half and Full Subtractors,		types logic gates and its		
	Magnitude Comparator, Encoders,		applications		
	Decoders, Multiplexers, Demultiplexer.			1,2	
IV	Memory element, Flip flops (SR, D, JK	5	A good knowledge on		T1,
	and T), counters, registers, Analog to		sequential circuit	1.0	R2
	Digital and Digital to analog converters,			1,2	
*7	Introduction to Microprocessors.	-	A 1 : C1		TF:1
V	Combinational Circuit Logic gates,	5	A brief knowledge on	1.2	T1
	Design of Half and Full Adders, Half		logic gates and its	1,2	
	and Full Subtractors, Magnitude		design.		
	Comparator, Encoders, Decoders,				
	Multiplexers, Demultiplexer.				

T1. Electronic Devices and Circuit Theory, R L Boylestad.

## Reference books

- R1: Modern Digital and Analog Communication Systems, B P Lathi.
- R2: Electronic Communication System, George Kennedy.
- R3. OPAMPS and Linear Integrated Circuits, Ramakant A Gayakwad.
- R4: Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, McGraw Hill.

# Other learning resources

1. https://www.youtube.com/watch?v=w8Dq8blTmSA

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe various semiconductor devices such as diodes and transistors	1				
2	Identify operational Amplifier and its applications.	1, 2, 3, 4, 6				
3	Define the building blocks of digital systems and combinational circuits	1, 2, 3, 4, 6				
4	Identify the basic concept of memory elements and sequential circuits.	1, 4				
5	Describe basic concepts of combination of logic gates	1, 2, 7				

		SEMEST	ER – II							
<b>Course Title</b>		Research Metho	odology and Sta	tistical	Ana	alysis	5			
Course code	24MSPH1205R	<b>Total credits:</b> 2	2	L	T	P	S	R	O/f	С
		<b>Total hours:15</b>	5T+60S	1	0	0	4	0	0	2
Pre-requisite	Nil	Co-requisite						N	il	
Anti- requisite	Nil			•						
Programmes		Master of Science in Physics								
Semester	$\mathbf{S}_{\mathbf{j}}$	Spring/II semester of First year of the programme								
Course	1. The course									
<b>Objectives</b>	methodology,									
	includingtheoryofs	-	-							
			e the students' sk			_	-			_
	through research					_		-		
	develop skills for	preparation of a	research propos	al for a	n mas	ster'	thesi	s pro	oject/	Mini
	research.				_					_
	1		petency in plan	nning,	cond	luctin	ıg, e	valu	ating	and
	presenting a resear	1 3								
Course			owledge of Research							
Outcomes		_	ledge of Research					~		•••
		_	n the Skill questi			_			dents	W1ll
	be able to acquire		_							
Course	This course offers	an overview of r	esearch methodo	ology 111	clud	ıng b	asıc	conc	epts	
Description	employed in	1::		1			1.		C	
	quantitative and qu	alitative research	h methods. Inclu	des cor	nput	er ap	plica	tions	for	
D - <b>f</b>	research.	4-1 C -41	aulas In. IM Ma	1:	4 1	~.: <u>4</u> :	1		:	
References	1. Boyle JS. Squalitative research	•	aphy. In: JM Mo	rse, eai	tor. v	_riliC	ai is	sues	ın	
	1 *	aks, CA: Sage,	1004-150 85							
			nd Ryan F. (200'	7) Ster	-hv-	cten	mide	e to c	ritia	iina
	research. Part 1:	wi., Croimi i . a	na Ryan I . (200	7). Step	)-0 y -	зіср ,	guia		mq	img
		research. Britis	h journal of Nurs	sing 16	(11)	_				
	1		alitative Inquiry	_			esign	Cho	osing	ŗ
	Among Five Tradi	` / `					2.8	0110	331112	,
		Oaks, CA: Sage l	Publications.							
			oundations of soc	ial rese	earch	: Me	aning	g and	l	
	perspective in the	` ′					,			
	9. process. Lo	ndon: Sage.								
	10. 5 Denzin, 1	IK. (1978). Soci	ological Method	s. New	Yorl	k: Mo	cGra	w-Hi	11.	
	11. 6 Hanson V	VE, JW Creswel	l, VL Plano Clarl	k, KS F	etsk	a and	l JD (	Cres	well.	
	Mixed Methods Re	search								
	12. Designs in	Counseling Psyc	chology. Journal	of Cou	nseli	ng Ps	sycho	ology	, 200	15,
	Vol. 52, No. 2, 224									
	_	-	art.net/chaplaincy		_				_	f
		,	2004). Education	al Rese	earch	: Qua	antita	ative	,	
	qualitative and mix	es								
Unit			Content							
I	Research Methodo									
	motivation in resea		-		crite	ria of	goo	d res	earch	l <b>.</b>
	Defining the Resea			ırch						
	problem, necessity		_							
II	Research Design-	neaning and nee	d of research des	sign, fe	ature	s of a	a goo	d de	sign,	

	different research designs, Sampling Design- steps in sampling design, Sample Size
	determination, criteria for selecting a sampling design, different types of sampling
	design, Experimental Design, Principles of Design of Experiment, One – way
	ANOVA, Two- Way ANOVA, CRD, RBD, LSD, 22, 23 Factorial Design
III	Types of data, sources of data collection, tools of data collection, Nominal, ordinal,
	interval and ratio
	- Attitude scale construction and measurement, rating scales, semantic differential
	(SD), Use of scale in statistical analysis, Schedules for interviews preparation and
	standardization, development of survey instruments and item analysis for the
	questionnaire
IV	Planning and organizing research report, Format of research report, Different steps of
	writing report,
	lay out of the research report, How to organize thesis/Dissertation, mechanics of
	writing research report, standard methods of quoting- presenting the result, written and
	oral reports, Uses of abstract, format
	of research report, presentation of statistics - tabular and graphic references and uses of
	references, Bibliography and presentation of bibliography
$\mathbf{V}$	Intellectual property right (IPR), Introduction and the need for IPR, IPR in India and
	worldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design,
	Traditional Knowledge and Geographical Indications, Patentable and non-patentable,
	patenting life, Filing of a patent application, The different layers of the international
	patent system, Case studies on Basmati rice, Turmeric, and Neem patents
Laboratory	Laboratory using R Software:
	1 Analysis of One way ANOVA; 2 Analysis of Two way ANOVA; 3 Analysis of CRD
	4 Analysis of RBD
	5 Analysis of 22 and 23 Factorial Experiment
	6 Simulation-I using R (Bernoulli, Binomial, Poisson and Geometric distribution.). 7
	Simulation-II using R (Exponential and Normal distribution).
	8 Simple random Sampling Stratified Random Sampling

T1.

#### Reference books

- 1. Boyle JS. Styles of ethnography. In: JM Morse, editor. Critical issues in qualitative research methods.
- 2. Thousand Oaks, CA: Sage, 1994:159-85.
- 3. Coughlan M., Cronin P. and Ryan F. (2007). Step-by-step guide to critiquing research. Part 1:
- 4. quantitative research. British journal of Nursing 16 (11).
- 5. Creswell, JW. (1998). Qualitative Inquiry and Research Design Choosing Among Five Traditions.
- 6. Thousand Oaks, CA: Sage Publications.
- 7. Crotty, M. (1998). The Foundations of social research: Meaning and perspective in the research process. London: Sage.
- 8. Denzin, NK. (1978). Sociological Methods. New York: McGraw-Hill.
- 9. Hanson WE, JW Creswell, VL Plano Clark, KS Petska and JD Creswell. Mixed Methods Research
- 10. Designs in Counseling Psychology. Journal of Counseling Psychology, 2005, Vol. 52, No. 2, 224
- 11. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes

#### Other learning resources

1. http://www.preciousheart.net/chaplaincy/Auditor Manual/13casesd.pdf

		SEMESTER – III							
<b>Course Title</b>	Atomic and Molecular Physics								
Course code	24MSPH2101R	Total credits: 4	L T P S R O/F C						С
		Total hours: 60T	4	0	0	0	0	0	4
<b>Pre-requisite</b>	Nil	Co-requisite					Nil		
Programmes		Master of Scienc	e in Phy	ysics					
Semester	Sp	ring/III Semester of First	Year of	the	Pro	gran	ıme		
Course	1. Introduction to emis	sion and absorption spectra of	the atom	ıs					
<b>Objectives</b>	2. Knowledge of differ	ent energy levels in atoms and	various	coup	ling	schei	nes.		
Ÿ	3. To know the Born-C	Oppenheimer Approximation ar	ıd its app	olicat	ion (	on mo	lecul	ar spectro	oscopy
Course	1.Identify different end	ergy levels of atoms, frequencies	s of spe	ctral	lines	of al	kali s	pectra	
Outcomes	2.Describe the concept	s of Zeeman effect, Paschen Ba	ack effec	et and	l Sta	rk eff	ect in	atomic s	pectrum.
	3.Define the concept o	n molecular spectra.							
	4.Acquire adequate ide	ea on Raman Spectroscopy.							
	5.Define the properties	of laser, various types of laser	s and the	eir wo	orkir	ıg pri	nciple	es.	
Course	The broad objective	of the course is to provide a	knowle	edge	aboı	it the	spec	etra of a	toms and
Description	ption molecules and lasers.								
Other learnin	g resources: https://v	vww.youtube.com/playlist?list=	=PLslAZ	zgdv	vx64	zd2R	PrcrF	xjt-1eSF	LVui

Unit-	Content	СН	<b>Learning Outcome</b>	KL	REF
No.					
I	Atomic emission and absorption spectra, fine structure of hydrogen atom, spectra of helium and alkali atoms, Lande interval rule, L-S and J-J coupling schemes.	10	To learn about the spectra of Hydrogen and alkali atoms, L-S and J-J coupling schemes	1,2	T1, R1
П	Zeeman effect, Paschen Back effect, Stark effect, Calculation of Zeeman pattern and intensity distribution in complex spectra. Hyperfine structure and determination of nuclear spin. Breadth of spectrum lines: Natural broadening, Doppler broadening, Collision broadening and Stark broadening.	12	To apply knowledge of Zeeman effect for Calculation of Zeeman pattern. To learn about Paschen Back effect, Stark effect, Hyperfine structure and Breadth of spectrum lines	1,2	T1, R1, R4
III	Rotation, vibration and rotation-vibration spectra of diatomic molecules, selection rules. Electronic spectra: Born-Oppenheimer approximation, formation of bands, progressions and sequences of vibrational bands, Intensity distribution, Franck Condon principle	10	To learn about Rotation, vibration and rotation- vibration spectra of diatomic molecules.	1,2	T2, R2
IV	Raman spectra: Classical theory of Raman effect, Vibrational Raman spectrum, selection rules, Stokes and antiStokes lines, Rotational Raman spectrum, selection rule.	5	To get knowledge of Raman effect and Rotational Raman spectrum	1,2, 3,4	T2, R2
V	Properties of laser light, spontaneous and stimulated emission – Einstein's coefficients, light amplification, population inversion and threshold condition for laser oscillations; optical resonator modes of a rectangular cavity, the quality factor (Q-factor). ammonia maser, Types of lasers: He-Ne laser, semiconductor lasers	10	To learn the applications of laser.	1,2, 3,4	T3, R3

- T1. Introduction to Atomic Spectra H E White.
- T2. Fundamentals of Molecular Spectroscopy C N Banwell and E M McCash.
- T3. Lasers: Theory and Applications K Thyagarajan and A K Ghatak.

## Reference books

- R1. Physics of atoms and molecules B H Bransden and C J Joachain
- R2. Spectra of Diatomic Molecules (Vol. 1) G Herzberg.
- R3. Laser Fundamentals: W.T silfvast.
- R4. Atoms, molecules and quanta: A. E. Ruark, HC. Urey.

## Other learning resources

https://www.youtube.com/playlist?list=PLslAZxgdwx64zd2RPrcrFxjt-1eSRLVui

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Identify different energy levels of atoms, frequencies of spectral lines of alkali spectra	1, 2, 4, 8				
2	Describe the concepts of Zeeman effect, Paschen Back effect and Stark effect in atomic spectrum.	1, 2, 3, 4, 8				
3	Define the concept on molecular spectra.	1, 2, 4, 8				
4	Acquire adequate idea on Raman Spectroscopy.	1, 2, 4, 8				
5	Define the properties of laser, various types of lasers and their working principles.	1, 2, 4, 8				

	SEMESTER – III								
Course Title	RI	RESEARCH PROJECT I (SURVEY/EXPERIMENTS-R1)							
Course code	24MSMB2104R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 8 (P)	0	0	8	0	0	0	4
Pre-requisite	Nil	Co-requisite				N	il		
Programmes		Master of Scien	ice in	Micro	biology	7			
Semester		Fall/III Semester of Sec	ond Y	ear of	the Pro	gramı	ne		
Course	1. To learn th	1. To learn the principles of designing effective surveys, including question formulation					ulation		
objectives	and sampli	ng techniques.							
	2. To gain ha	nds-on experience in desig	gning a	and co	nductin	g resea	rch exp	eriments	to test
	hypotheses								
CO1	Formulate research	methodology							
CO2	Prepare research to	ol(s)							
CO3	Apply the knowled	Apply the knowledge of sampling methods in sample collection.							
CO4	Design experiment	Design experiment using scientific method							
CO5	Investigate the rese	arch Problem							

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Formulate research methodology	1, 2, 4, 6, 7					
2	Prepare research tool(s)	1, 3, 4					
3	Apply the knowledge of sampling methods in sample collection.	1, 2, 3, 4					
4	Design experiment using scientific method	1, 2, 3, 4, 6					
5	Investigate the research Problem	1, 2, 3, 4, 7					

		SEMESTER	R – III							
Course Ti	tle	Nuclear Physics I								
Course co	de 24MSPH1203R	Total credits: 4		L T P S R (				O/F	C	
		Total hours: 60 T		4	0	0	0	0	0	4
Pre-requis	site Nil	Co-requisite					l	Nil	'	
Anti-requi	site Nil									
Programn	nes	Master of	Science	in Phy	sics					
Semeste	r	Spring/II Semester of	f First Y	ear of t	he Pr	ogra	mme			
Course	1. To impart know	ledge about basic nuclear p	hysics p	ropertie	es and	relat	ed rea	action	dynami	ics.
Objective		e concept of bound state pr								
	3. To familiarize	with the fundamental force	s and the	dynam	ics of	elem	entar	y parti	icles un	der these
	force.									
	4. To give basic id	4. To give basic ideas on Beta decay and its importance in nuclear physics.								
	5. To introduce pr	operties of nuclei and detai	ls of pop	ular nuo	clear 1	node	ls			
Course	1. Describe	1. Describe basic properties of nuclei, nuclear interactions, nuclear structure and reactions.								
Outcome	es 2. Apply law	2. Apply laws of conservation and momentum in determination of particle properties and								
	properties of proc	esses in the subatomic worl	d.							
	3. Describe	bound state problems and p	roperties	of deut	teron	grour	d sta	te with	square	well
	potential.									
	4. Explain b	4. Explain beta decay and properties of neutrino.								
	5. Identify the									
Course	The course will d	The course will discuss nuclear physics. Properties of nuclei and details of popular nuclear models,								
Description	properties of nucl	properties of nuclear decays and nuclear reactions will be discussed in brief, but in a self-consistent								
•		manner. Study of different nuclear models are also included in the course.								
Other learn	ning resources: https://	/www.sciencedirect.com/t	opics/ph	ysics/n	uclea	r-phy	sics			
Unit-No.	C	ontent	СН	Learni	ing O	utcoi	ne		KL	Re
I	Size of the nucleus and	l its determination from		Introdu	ictory	knov	vledg	e and		T1
	electron, scattering.		7	refresh	ing th	e exi	sting			
				unders	tandir	ıg			1,2	

Unit-No.	Content	CH	<b>Learning Outcome</b>	KL	Ref
I	Size of the nucleus and its determination from		Introductory knowledge and		T1
	electron, scattering.	7	refreshing the existing		
			understanding	1,2	
II	Bound state problems: properties of deuteron		Concept of bound states to		T1, R1
	ground state with square well potential, magnetic	10	solve problems	1,2	
	dipole moment and electric quadruple moment of				
	deuteron.				
III	Nucleon stability; mass parabolas- prediction of	10	Knowledge on nuclear		T1
	stability against β decay; stability limits against		stability and shell model		
	spontaneous fission. Shell model			1,2	
IV	Beta-decay: Fermi's theory of beta decay, Curie's	8	Concept of beta decay and	1,2	T1, R2
	plot, parity violation in beta-decay.		elementary particle neutrino		
V	Nuclear Models: Liquid drop model: Binding	10	Knowledge on different	1,2	T1
	energy, semi empirical mass formula, nuclear		nuclear models		
	stability, shell model				

T1. Nuclear Structure Vol. 1 & 2., A Bohr & Ben R. Mottelson, World Scientific.

### Reference books

- R1. Introductory Nuclear Physics, Samuel S. M. Wong, Wiley-Vch.
- R2: Fundamentals in Nuclear Physics, Jean-Louis Basdevant, James Rich, Michel Spiro, Springer
- R3 S. N. Ghoshal. Nuclear Physics, S.Chand Publications

# Other learning resources

 $\underline{https://www.sciencedirect.com/topics/physics/nuclear-physics}.$ 

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe basic properties of nuclei, nuclear interactions, nuclear structure and reactions.	1, 3					
2	Apply laws of conservation and momentum in determination of particle properties and properties of processes in the subatomic world.	1, 3, 4, 7					
3	Describe bound state problems and properties of deuteron ground state with square well potential.	1, 2, 3, 4, 8					
4	Explain beta decay and properties of neutrino.	1, 2, 3, 8					
5	Identify the strengths and limitations of various nuclear models.	1, 3, 4, 8					

	SEMESTER – IV								
Course Title		<b>Condensed Matter Physics</b>							
Course code	24MSPH1202R Total credits: 4 L T P S R						O/F	C	
		Total hours: 45T+30P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite				N	il		
Anti-requisite	Nil								
Programmes		Master of Science	in Ph	ysics					
Semester		Spring/IV Semester of Second	Year o	of the	Prog	gramn	ne		
Course objectives		lents understand the crystal struct							
		lents learn physics behind the form					-	-	
		natures of electrical and thermal	conduc	ctiviti	es of	metal	s from	free elec	etron
	theory of metals								
Course outcomes		e crystalline state of solids and X-	-	fracti	on				
		ne crystal bonding and lattice dyna							
		he electric and magnetic propertion	es of s	olids					
		the lattice vibration in solids.							
	5. Define the	e properties of semiconductors.							
Course		t acquiring the knowledge of mat				•			
Description		gnetic properties. The students wil			-				
	extent and nature	of crystallinity, conductivity, defe	cts etc	. and	the w	ay the	ese affe	ect some	basic
	properties.								
Text Books	T1. Solid State Ph	ysics, A J Dekker.							
Reference Books	R1. Introduction to	o Solid State Physics, C Kittel				_			
	R2. Lattice Dynar	nics, A K Ghatak and L S Kothari							
	R3. Solid State Ph	ysics, N W Ashcroft and N D Me	rmin.						
Other learning res	ources: https://www	w.britannica.com/science/condens	ed-ma	tter-p	hysic	es			

Unit	Content	СН	Learning Outcome	KL	Ref
No.					
I	Amorphous and Crystalline Materials.		Knowledge of crystal structure		T1
	Lattice Translation Vectors. Unit Cell.		and laws		
	Miller Indices. Reciprocal Lattice.	7		1,2	
	Types of Lattices. Diffraction of X-				
	rays by Crystals. Bragg's Law.				
II	Elementary Lattice Dynamics:		Knowledge on elementary		T1,
	Lattice Vibrations and Phonons:		lattice dynamics		R1
	Linear Monoatomic and Diatomic				
	Chains. Acoustical and Optical				
	Phonons. Dulong and Petit's Law,				
	Einstein and Debye theories of	10		1,2	
	specific heat of solids. T3 law				
III	Dia-, Para-, Ferri- and Ferromagnetic		Knowledge on Magnetic		T1
	Materials. Classical Langevin Theory		Properties of Matter		
	of dia- and Paramagnetic Domains.	10		1,2	
	Curie's law, Weiss's law				
IV	Bloch function, Kronig-Penney model,		Knowledge on theoretical and		T1,
	Brillouin zones, effective mass of	8	mathematical model of crystal	1,2	R2
	charge carriers. Tight binding and		structure.		
	Wigner - Seitz method.				
V	Intrinsic and extrinsic semiconductor,		Theoretical and practical		T1
	number density of carriers in intrinsic		knowledge of semiconductors.		
	and extrinsic semiconductors,				
	expression for Fermi levels,	10		1,2	
	photoconductivity, Hall effect in				
	metals and semiconductors.				

T1. Solid State Physics, A J Dekker.

## Reference books

- R1. Introduction to Solid State Physics, C Kittel
- R2. Lattice Dynamics, A K Ghatak and L S Kothari
- R3. Solid State Physics, N W Ashcroft and N D Mermin.

## Other learning resources

https://www.britannica.com/science/condensed-matter-physics

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Define the crystalline state of solids and X-ray diffraction	1,3					
2	Identify the crystal bonding and lattice dynamics	1, 3, 4, 7					
3	Describe the electric and magnetic properties of solids	1, 2, 3, 4, 8					
4	Describe the lattice vibration in solids.	1, 2, 3, 8					
5	Define the properties of semiconductors.	1, 3, 4, 8					

1		SEMESTI	ER – III						
Cou	rse Title	SENIES 1	Astrop						
	rse Code	24MSPH2103R Total Credits: 4		L	T P	S	R	O/F	С
		Total Hours:		4	0 0	0	0	0	4
Pre-	Requisite	CO-REQUISIT	E			NA			1
	Requisite	NA							
Prog	grammes			nce in Physics					
Se	mester	Fall/ 3 rd Semes	ter of 2 ⁿ	d year of the pro	gram				
C	Course	1. 1. To impart adequate knowledge		· ·					
Ob	jectives	2. 2. To study about the stellar structure.	acture, s	tellar evolution,	the solar	systen	n, fo	rmatio	on of
		galaxies and stars.							
	Course	1. Identify and get adequate idea	on asti	ronomical observ	vation, M	lagnitu	de s	scales,	and
Ou	itcomes	various types of astronomical telescopes.		C 1 . 1 .	1 .			ъ	
		2. Describe Interstellar matter, Form	nation o	f galaxies and st	ar clusters	s, Hert	zspr	ung-K	ussei
		<ul><li>diagram.</li><li>3. Define the concept on stellar structure.</li></ul>	cture ste	ellar evolution R	lack holes	and o	amn	na raw	
		bursts.	ciure, sic	mar evolution, B	iack noics	and g	411111	ia ray	
		4. Identify the energy production in	stars e.g	. p-p chain, carbo	on-nitroge	n-oxvs	en c	vele a	ınd
		Triple alpha process.	C	, 11	J	, ,		,	
		5. Define Hubble's classification of	galaxies	, surface brightne	ess, galact	ic cent	er aı	nd Act	ive
		galactic nuclei.							
	Course	Astrophysics courses study about the Cel		•	, Interstell	ar mat	ter,	stellar	
	cription	evolution, the solar system, formation of	galaxies	and stars.					
	t Books	T1: Astrophysics - Baidyanath Basu.							
	ference	R1: Physics of Stars - A C Phillips. R2: Introduction to stellar structure – S. C	<b></b>	-1-1					
ı	Books	R3: Astrophysics: Stars and Galaxies - K.			ios Dross				
		R4: Introduction to stellar astrophysics - I			168 1 1688				
Other	r Learning	Resources: https://www.youtube.com/cl			N410w7k		<b>O</b>		
Unit		Content	СН	Learning ou		KL		RE	F
no									
I	The celest	ial sphere, Celestial coordinate systems,	10	To learn the Ce	lestial	1,2	7	Γ1, R1	, R2
I	Concept o	f time — solar time and sidereal time.	10	coordinate syste	ems,	1,2	7	Γ1, R1	, R2
I	Concept of Magnitude	f time — solar time and sidereal time. e scales, colour index, apparent, absolute	10	coordinate syste	ems, ite	1,2	7	Γ1, R1	, R2
I	Concept of Magnitude and instru	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of	10	coordinate syste apparent, absolu magnitudes and	ems, ite various	1,2	7	Γ1, R1	, R2
I	Concept of Magnitude and instru	f time — solar time and sidereal time. e scales, colour index, apparent, absolute	10	coordinate syste apparent, absolu magnitudes and types of astrono	ems, ite various	1,2	Т	Γ1, R1	, R2
	Concept of Magnitude and instru astronomi	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.		coordinate syste apparent, absolu magnitudes and types of astrono telescopes	ems, ute various omical				
I	Concept of Magnitude and instruction astronomial Interstella	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star	10	coordinate syste apparent, absolu magnitudes and types of astrono telescopes To get the basic	ems, ite various omical	1,2		Τ1, R1	
	Concept of Magnitude and instru astronomi Interstella clusters. I	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star Gree-fall collapse and formation of stars.		coordinate syste apparent, absolu magnitudes and types of astrono telescopes  To get the basic Interstellar matt	ems, ute various omical ideas on eer,				
	Concept of Magnitude and instru astronomi Interstella clusters. I Hertzspru	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star Free-fall collapse and formation of stars. ng-Russel (H-R) diagram and stellar		coordinate syste apparent, absolu magnitudes and types of astrono telescopes To get the basic	ems, ate various omical ideas on er, alaxies				
	Concept of Magnitude and instru astronomi Interstella clusters. I Hertzspru classificat	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star Gree-fall collapse and formation of stars.		coordinate syste apparent, absolu magnitudes and types of astrono telescopes To get the basic Interstellar matt Formation of ga	ems, ate various omical ideas on er, alaxies				
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п	Concept of Magnitude and instru astronomi  Interstella clusters. I Hertzspru classificat and post-r Stellar struequilibrius	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star free-fall collapse and formation of stars. ng-Russel (H-R) diagram and stellar ion. Stellar spectra. Main sequence, pre- nain sequence stars. Red giants. acture and evolution: Hydrostatic m. Stellar structure equations. Polytropic	10	coordinate syste apparent, absolut magnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of ga and star clusters  To get the basic knowledge of star coordinate systems.	ems, atte various emical ideas on eer, alaxies	1,2		T1, I	R2
п	Concept of Magnitude and instru astronomi  Interstella clusters. I Hertzspru classificat and post-r Stellar struequilibrius stars and r	of time — solar time and sidereal time.  The scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  The matter, Formation of galaxies and star free-fall collapse and formation of stars. Ing-Russel (H-R) diagram and stellar ion. Stellar spectra. Main sequence, premain sequence stars. Red giants.  The cucture and evolution: Hydrostatic manner. Stellar structure equations. Polytropic related integral theorems. Stellar	10	coordinate syste apparent, absolum agnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of gaand star clusters  To get the basic knowledge of started to structure and events apparent to the system of the started to the system of the started to the system of the	ems, atte various omical ideas on er, alaxies s.	1,2		T1, I	R2
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п	Concept of Magnitude and instru astronomi  Interstella clusters. I Hertzspru classificat and post-r Stellar struequilibrius stars and ratmospher collapse, o	of time — solar time and sidereal time.  Description of galaxies and star free-fall collapse and formation of stars.  Description of galaxies and stars.  Description of galax	10	coordinate syste apparent, absolut magnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of ga and star clusters  To get the basic knowledge of st structure and even white dwarf and star. Supernoval	ems, atte various omical ideas on er, alaxies s.	1,2		T1, I	R2
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III	Concept of Magnitude and instru astronomi.  Interstella clusters. If Hertzspruclassificat and post-requilibrium stars and reatmosphere collapse, of white dwarf holes and Energy preaction.	f time — solar time and sidereal time. e scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  r matter, Formation of galaxies and star free-fall collapse and formation of stars. ng-Russel (H-R) diagram and stellar ion. Stellar spectra. Main sequence, pre- nain sequence stars. Red giants. Lecture and evolution: Hydrostatic m. Stellar structure equations. Polytropic related integral theorems. Stellar re and Saha equation. Gravitational degeneracy pressure in stars – structure of urf and neutron star. Supernova, Black gamma ray bursts.  production in stars: nuclear reactions, rates, p-p chain and carbon-nitrogen-	10	coordinate syste apparent, absolumagnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of ga and star clusters  To get the basic knowledge of st structure and even white dwarf and star. Supernova holes and gamm bursts.  To learn about to various nuclear	ems, atte various omical ideas on ter, alaxies s	1,2	1	T1, I	R2
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III	Concept of Magnitude and instru astronomi Interstella clusters. I Hertzspru classificat and post-r Stellar struequilibrium stars and requilibrium stars and redulated with the dwarf atmosphere collapse, of white dwarf holes and Energy preaction oxygen (C System:	of time — solar time and sidereal time.  The scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  The matter, Formation of galaxies and stare free-fall collapse and formation of stars. Ing-Russel (H-R) diagram and stellar ion. Stellar spectra. Main sequence, premain sequence stars. Red giants. Incuture and evolution: Hydrostatic main. Stellar structure equations. Polytropic related integral theorems. Stellar re and Saha equation. Gravitational degeneracy pressure in stars — structure of arf and neutron star. Supernova, Black gamma ray bursts.  The production in stars: nuclear reactions, rates, p-p chain and carbon-nitrogen-CNO) cycle, Triple alpha process. Solar	10	coordinate syste apparent, absolum agnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of ga and star clusters  To get the basic knowledge of st structure and even white dwarf and star. Supernoval holes and gamm bursts.  To learn about the various nuclear for energy products.	ems, atte various omical ideas on eer, alaxies s	1,2	1	T1, I	R2
III	Concept of Magnitude and instru astronomi Interstella clusters. I Hertzspru classificat and post-r Stellar struequilibrius stars and ratmospher collapse, of white dwa holes and Energy preaction oxygen (C System:	of time — solar time and sidereal time.  The scales, colour index, apparent, absolute mental magnitudes. Different types of cal telescopes and their mounts.  The matter, Formation of galaxies and star Free-fall collapse and formation of stars. Ing-Russel (H-R) diagram and stellar ion. Stellar spectra. Main sequence, premain sequence stars. Red giants. Incuture and evolution: Hydrostatic manufacture and evolution: Hydrostatic manufacture and star structure equations. Polytropic related integral theorems. Stellar related integral theorems. Stellar related integral theorems. Stellar related integral theorems. Supernova, Black gamma ray bursts.  The structure of the stars in the stars in the structure of the stars in the stars in the stars. The structure of the stars in the star	10	coordinate syste apparent, absolut magnitudes and types of astrono telescopes  To get the basic Interstellar matt Formation of ga and star clusters  To get the basic knowledge of st structure and even white dwarf and star. Supernoval holes and gamm bursts.  To learn about to various nuclear for energy prodistars, sun and so	ems, atte various omical ideas on er, alaxies s. ellar colution, d neutron a Black na ray the reactions uction in olar ls,	1,2	1	T1, I	R2

V	Galaxies: Hubble's classification of galaxies,	5	To give the basic idea	1,2,	T1, R3, R4
	properties of spirals, ellipticals and lenticular		of Hubble's	3,4	
	galaxies, surface brightness, distribution of light		classification of		
	and mass, the galactic centre, 21 cm line, Active		galaxies, the galactic		
	galactic nuclei.		centre, 21 cm line,		
			Active galactic nuclei.		

T1. Astrophysics - Baidyanath Basu.

## Reference books

R1: Physics of Stars - A C Phillips.

R2: Introduction to stellar structure – S. Chandrasekhar

R3: Astrophysics: Stars and Galaxies - K. D. Abhyankar, Universities Press

R4: Introduction to stellar astrophysics - Francis LeBlanc, Wiley

## Other learning resources

https://www.youtube.com/channel/UC-UUo6Y7fP0N41Qw7KcKtcQ

CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Identify and get adequate idea on astronomical observation, Magnitude scales, and various types of astronomical telescopes.	1, 3,				
2	Describe Interstellar matter, Formation of galaxies and star clusters, Hertzsprung-Russel diagram.	1, 3, 4, 7				
3	Define the concept on stellar structure, stellar evolution, Black holes and gamma ray bursts.	1, 2, 3, 4, 8				
4	Identify the energy production in stars e.g. p-p chain, carbon- nitrogen-oxygen cycle and Triple alpha process.	1, 2, 3, 8				
5	Define Hubble's classification of galaxies, surface brightness, galactic center and Active galactic nuclei	1, 3, 4, 8				

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T1, R1	-
#4 P4	
T1, R1	
T1 D2	
11, K2	•
T1, R2	
11,112	
T1. R2	
110112	
11,112	
11,112	
11,112	
_	T1, R2

T1. Introduction to Plasma Physics and Controlled Fusion: F F Chen.

## Reference books

R1: Fundamentals of Plasma Physics: J J Bittencourt

# Other learning resources

https://www.youtube.com/playlist?list=PLbMVogVj5nJS4KY5UFWBLSu7kMzPbL35T

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Identify the basic concepts of plasma	1,3					
2	Describe the plasma motion and its variation with electric and magnetic field.	1, 3, 4, 7					
3	Define the plasma fluid nature	1, 2, 3, 4, 8					
4	Describe the need of kinetic theory in plasma	1, 2, 3, 8					
5	Identify the nature of plasma waves in the universe	1, 3, 4, 8					

			SEMESTE	ZR – II	I						
Course	Title		No	n- Lin	ear Optics						
Course	Code	24MSPH2104R	<b>Total Credits</b>	s: 4	]	LT	P	S	R	O/F	C
			<b>Total Hours:</b>			4 0	0	0	0	0	4
Pre- Rec	quisite		CO-REQUIS	ITE		<u> </u>		NA			
Anti- Re	quisite	NA									
Prograi	mmes		Master	of Sci	ence in Phy	sics					
Seme	ster	]	Fall/ 3 rd Semest	ter of 2	e nd year of t	he prog	gram				
Cour	rse	1. The students will	be able to under	stand t	he Spectros	copic a	spects	of nor	nlinear	optics	s.
Object	tives	2. The students will	be able to learn	about 1	Non-linear j	processe	es and	multi-	photo	n	
		processes.									
Cour	rse	1. Describe the propagation	•	_		n nonlir	iear op	otical r	nedia.		
Outco	mes	2. Define the concep		_							
		3. Identify Phase-ma			onlinear op	ics					
		4. Identify the multi-									
		5. Identify Rayleigh		_		_					
Cour		This course deals with the	Spectroscopic a	aspects	of nonlinea	r optics	and F	Raman	scatte	ring.	
Descrip											
Text B		T1: Nonlinear Optics: R.W									
	Reference R1: Laser and Nonlinear Optics: B. B Land, New Age International. R2: Essentials of Laser & Nonlinear Optics: G. D. Baruah, Pragati Prakashan										
Boo			•				rakas	han			
	earning	· · · · · · · · · · · · · · · · · · ·	<u>/.youtube.com/</u>							TZT	REF
Unit no	NI I	Content		CH		earning					
I	1	inear Optics introduction, p		10	To learn the		_			1,2	T1,
	electromagnetic wave in nonlinear optical media, nonlinear optical susceptibility.				electromag		ave ii	ı nonii	near		R1
II	Harmo			0	-		daaal	20114		1.2	T1,
11	genera	· ·		0	8 To get the knowledge about 1,2 harmonic generation, second						R2
	_	tion, third-harmonic gene			harmonic	_		cond			IX2
	_	ng technique, parametric g	=		narmome	Scholan	.011				
	focusii		eneration, sen								
III		matching technique, param	etric	8	To get the	basic id	lea on	third-		z	T1,
	1	tion, self-focusing.			harmonic				ric	_	R1
		, <u>8</u> .			generation	_	_				
IV	Multi-	quantum photoelectric eff	ect, two- and	10	To unders					1,2,	T1,
	1	photon processes, experime			quantum p	hotoele	ctric e	ffect,	two-		R2
	1	ase conjugation optics.	_		and three-						
	_	-			phase con	ugation	optic	s.			
V	Raylei	gh and Raman scatter	ring, inelastic	9	To learn a	bout sti	mulate	d Ran	nan	1,2,	T1,
	scatter	ing processes, Stokes	anti-Stokes		scattering					3,4	R1,
	coupli	ng, stimulated Raman scatt	ering.								R2

T1. Nonlinear Optics: R.W Boyd. Academic Press.

#### Reference books

R1: Laser and Nonlinear Optics: B. B Land, New Age International.

R2: Essentials of Laser & Nonlinear Optics: G. D. Baruah, Pragati Prakashan

# Other learning resources

1. <a href="https://www.youtube.com/watch?v=jbzx-4L4W1s">https://www.youtube.com/watch?v=jbzx-4L4W1s</a>

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe the propagation of electromagnetic wave in nonlinear optical media.	1,3						
2	Define the concept about non-linear processes.	1, 3, 4, 7						
3	Identify Phase-matching techniques in nonlinear optics	1, 2, 3, 4, 8						
4	Identify the multi-photon processes.	1, 2, 3, 8						
5	Identify Rayleigh and Raman scattering in nonlinear optics	1, 3, 4, 8						

	SEMESTER – IV								
Course Title	RESEARCH PROJECT II (RESEARCH DATA ANALYSIS AND DOCUMENTATION-								
	R4)								
Course code	23MSMB221R	Total credits: 16	L T P S R O/				O/F	C	
		Total hours: 32(P)	0	0	32	0	0	0	16
Pre-requisite	Nil	Co-requisite				Nil			
Programmes		Master of S	cience	in Phy	ysics				
Semester		Spring/IV Semester of Second Year of the Programme							
Course	1. To enabl	e students to apply experi	mental	metho	ds to so	lve a g	iven sci	entific ta	sk.
Objectives	2. To be ab	le to analyse research data	ı						
	3. To be ab	le to compile and docume	nt rese	arch da	ata.				
CO1	Learn to tabulate res	search data							
CO2	Analyze research ou	itcomes							
CO3	Corelate with exitin	g literature							
CO4	Prepare an effective	dissertation report							
CO5	Able to communica	te research outcome							

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Learn to tabulate research data	1, 2, 3, 4, 6, 7					
2	Analyze research outcomes	1, 2, 3, 4, 6, 7					
3	Corelate with exiting literature	3, 4, 6, 7					
4	Prepare an effective dissertation report	1, 2, 3, 5, 6, 7					
5	Able to communicate research outcome	5, 6					

	SEMESTER – IV										
Cou	Course Title Nuclear Physics II										
Cou	rse code	24MSPH1203R	Total credits: 4		L	T	P	S	R	O/F	C
			Total hours: 60 T		4	0	0	0	0	0	4
Pre-	requisite	Nil	Co-requisite		Nil						
Anti-	requisite	Nil									
Prog	grammes	Master of Science in Physics									
Se	mester	Spring/IV Semester of Second Year of the Programme									
C	ourse	1. To impart knowledge about basic nuclear physics properties and related reaction dynamics.									
Objectives		2. To introduce the concept of bound state problem.									
		3. To familiarize with the fundamental forces and the dynamics of elementary particles under									
		these force.									
		4. To give basic ideas on Beta decay and its importance in nuclear physics.									
			erties of nuclei and details								
C	ourse		ic properties of nuclei, nu								
ou	tcomes	1	of conservation and mome		n determir	nation	of pa	rticle	prope	rties a	and
			es in the subatomic world								
			and state problems and pro	operties	s of deuter	on gro	ound s	tate v	with so	quare	well
		potential.									
		_	decay and properties of n								
		5. Identify the strengths and limitations of various nuclear models.									
	ourse	The course will discuss nuclear physics. Properties of nuclei and details of popular nuclear									
Des	cription	models, properties of nuclear decays and nuclear reactions will be discussed in brief, but in a self-									
		consistent manner. Study of different nuclear models are also included in the course.									
	t books	T1. Nuclear Structure Vol. 1 & 2., A Bohr & Ben R. Mottelson, World Scientific.  R1. Introductory Nuclear Physics, Samuel S. M. Wong, Wiley-Vch									
	ference	•	•				S: 1	. e [.] 1	10.	<b>C</b>	
b	ooks		Nuclear Physics, Jean-Lo			ames	Rich,	Mıch	el Spi	ro, Sp	oringer
Other	laarning		uclear Physics, S.Chand P w.sciencedirect.com/top			or ni	weice				
Unit-		esources. <u>ittps://ww</u>	w.scienceun ect.com/top	CH	Learning				KL		Ref
No.	Content				Learning	, Out	Julic		IXL		IXI
I	Size of the	e nucleus and its deter	mination from electron,		Introduct	orv kr	owle	dge			T1
_		; form factor; angular	,	7	and refre	•					
	moments.	, , ,	, 1		existing u	_		ıg	1,2	.	
II	Bound sta	te problems: propertie	s of deuteron ground		Concept			_			`1, R1
		square well potential,	•	10	to solve p				1,2		
	moment a	nd electric quadruple	moment of deuteron.		_						
III	Nucleon s	tability; mass parabola	as- prediction of		Knowled	ge on	nucle	ar			T1
			stability limits against		stability a	and sh	ell mo	odel			
	spontaneo	us fission. Shell me	odel: evidence of shell	10					1,2		
	structure;	magic numbers; e	ffective single particle								
	_	_	nonic oscillator; extreme								
single particle models-its success and failures in											
		ground state spin;par	•								
IV		•	eta decay, Curie's plot,		Concept			-		T	1, R2
		lation in beta-decay ar	_	and elementary particle							
1 -		f neutrino mass and os		8	neutrino				, _		
_			concept of double beta						1,2		
<b>T</b> 7					V 1 1	~~ -	1:cc				Tr1
V				10		_		ent	1 2		11
	_	nivai mass minuiä, m	icical stability, shell	10	nucieai II	100018			1,2		
V	Nuclear M	ecay and Majorana neutrino, radioactive dating uclear Models: Liquid drop model: Binding energy, emi empirical mass formula, nuclear stability, shell odel		Knowledge on different nuclear models 1,2				T1			

T1. Nuclear Structure Vol. 1 & 2., A Bohr & Ben R. Mottelson, World Scientific.

#### Reference books

R1. Introductory Nuclear Physics, Samuel S. M. Wong, Wiley-Vch.

R2: Fundamentals in Nuclear Physics, Jean-Louis Basdevant, James Rich, Michel Spiro, Springer

R3 S. N. Ghoshal. Nuclear Physics, S.Chand Publications

## Other learning resources

https://www.sciencedirect.com/topics/physics/nuclear-physics.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe basic properties of nuclei, nuclear interactions, nuclear structure and reactions.	1,3				
2	Apply laws of conservation and momentum in determination of particle properties and properties of processes in the subatomic world.	1, 3, 4, 7				
3	Describe bound state problems and properties of deuteron ground state with square well potential.	1, 2, 3, 4, 8				
4	Explain beta decay and properties of neutrino.	1, 2, 3, 8				
5	Identify the strengths and limitations of various nuclear models	1, 3, 4, 8				

SEMESTER – III									
Course Title	rse Title Advanced Condense Matter Physics								
Course code	24MSPH1202R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 45T+30P	3	0	2	0	0	0	4
Pre-requisite	Pre-requisite Nil Co-requisite Nil					•			
Anti-requisite	Nil								
Programmes		Master of Science	in Phys	sics					
Semester		Spring/II Semester of First Y	ear of t	he Pro	gram	ıme			
Course	1. To make studen	ts understand the electrical pro	perties o	f solid	l <b>.</b>				
objectives	2. To make students learn physics behind superconductivity.								
	3. To understand the physics of thin film and critical phenomena.								
Course	Learn about advanced electrical properties of solids.								
outcomes	2. Learn about advanced semiconductor physics.								
	3. Learn about superconductivity.								
	4. Learn about physics of thin films.								
	5. Learn about critical phenomena.								
Course	This course aims at acquiring the knowledge of matter in the condensed phase, their structural,								
Description	electrical, and magnetic properties. The students will be able to compute parameters related to								
	extent and nature of crystallinity, conductivity, defects etc. and the way these affect some basic								
	properties.								
Text books	T1. Solid State Physics, A J Dekker.								
Reference books	R1. Introduction to Solid State Physics, C Kittel								
	R2. Lattice Dynamics, A K Ghatak and L S Kothari								
	R3. Solid State Physics, N W Ashcroft and N D Mermin.								
Other learning resources: https://www.britannica.com/science/condensed-matter-physics									

Other learning resources: <a href="https://www.britannica.com/science/condensed-matter-physics">https://www.britannica.com/science/condensed-matter-physics</a>

Unit	Content	СН	Learning Outcome	KL	Ref
No.					
I	Band theory of solids, nearly free electron model,		Learn about advanced		T1
	tight binding approximation, Dielectric constant,		electrical properties of		
	polarizability, Kronig-Kramer relations.	7	solids.	1,2	
II	Thermodynamics of superconductivity, Rutger's		Learn about		T1,
	formula, Isotope effect, London equations, Cooper		superconductivity.		R1
	pairs, electron-phonon interaction, BCS theory, flux				
	quantization, A.C. & D.C. Josephson effects, High				
	temperature super conductors, SQUIDS, super				
	conducting magnets, Application and limitations of	10		1,2	
	HTSC.				
III	Density of states and statistics of impurity semi		Learn about advanced		T1
	conductors, scattering mechanism and mobility of		semiconductor physics.		
	charge carriers, transport carriers, continuity	10		1,2	
	equation, surface recombination steady state and				
	transient photo-conductivity, theory of simplified				
	model of abrupt p-n junction, p-n junction rectifier				
	and transistor, break down in p-n junction, P-N				
	junction based devices: Tunnel diodes metal				
	semiconductor junctions, semi conductor homo and				
	hetero junctions, I-V characteristics of junctions,				
	photo- generation at p-n junction, photo voltaic				
	effect, Gunn effect				
IV	Thin and thick films and, their differences,		Learn about physics of		T1,
	deposition techniques of thin film-vacuum		thin films.		R2
	evaporation, sputtering, chemical vapour deposition,				
	molecular beam epitaxy. Nucleation and growth				
	process, epitaxial growth techniques for measuring	8		1,2	
	this film thickness, size effect-change of electrical				
	resistivity of thin films of metal, F-S theory,				

	application of thin films.				
V	Phase transitions in different systems, first order and second order phase transitions, thermodynamics and statistical mechanics of phase transition, examples of critical phenomena: liquid-gas, paramagnetic-ferromagnetic, normal to superconductor, and superfluid transitions, phase diagrams, critical point exponents and exponent inequalities.	10	Learn about critical phenomena	1,2	T1

T1. Solid State Physics, A J Dekker.

#### Reference books

- R1. Introduction to Solid State Physics, C Kittel
- R2. Lattice Dynamics, A K Ghatak and L S Kothari
- R3. Solid State Physics, N W Ashcroft and N D Mermin.

#### Other learning resources

https://www.britannica.com/science/condensed-matter-physics

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Learn about advanced electrical properties of solids.	1,3					
2	Learn about advanced semiconductor physics.	1, 3, 4, 7					
3	Learn about superconductivity.	1, 2, 3, 4, 8					
4	Learn about physics of thin films	1, 2, 3, 8					
5	Learn about critical phenomena.	1, 3, 4, 8					

SEMESTER – IV					
Course Title General Theory of Relativity & Cosmology					
Course code 24MSPH2202R Total credits: 4 L T P S R O/I	7 C 4				
Total hours: 60T 4 0 2 0 0 0  Pre-requisite Nil Co-requisite Nil	4				
1 1					
1					
Programmes Master of Science in Physics Semester Spring/IV Semester					
Course 1.To learn about basics of General Theory of Relativity and Cosmology.					
objectives 2. To understand about metric tensor, motion in the gravitational field, bending of lig	ht				
gravitational waves and Big Bang cosmological models.					
3. Enable to apply theoretical knowledge of relativity in the practical field of relativity	·.				
Course  1. Describe the concept general theory of relativity, principle of equivalence, principle.					
outcomes congruence.	pic of general				
2. Describe adequate idea on tensors, motion in the gravitational field					
3. Verify different types of tensors like covariant, contravariant tensors and metric to	nsor.				
4. Describe the idea on rotating black holes and gravitational waves					
5. Describe the Cosmological principle, Big Bang Nucleosynthesis, dark matter and	dark energy.				
Course The course aims to provide adequate understanding to the elements of the General T	neory of				
Description Relativity and Cosmology.					
Other learning resources: <a href="https://www.britannica.com/science/general-relativity">https://www.britannica.com/science/general-relativity</a>					
Unit Content CH Learning Outcome KL	Ref				
No.					
1 General relativity – special theory of relativity,					
equality of gravitational and inertial masses,					
Principle of equivalence, Principle of General					
Congruence.	701				
2 Gravity as metric phenomenon, geodesic, 6 To understand the	T1,				
curvature, energy – momentum tensor, Einstein's law of gravitation (field equations), Newtonian theory of relativity.	R1				
approximation, Symmetries in general relativity					
Killing vector, test particle orbits for massive and					
massless particles.					
Tensor Analysis: Covariant and contravariant 10 To learn about	T1,				
3 tensors, quotient rule, metric tensor. Christoffel metric tensor,	R1,				
symbol, covariant derivative of contravariant and Einstein's law of	R2				
covariant tensors, Einstein tensor. gravitation (field 1,2					
equations),					
Newtonian					
approximation,					
Gravity as metric					
phenomenon.					
Schwarzschild solution, Schwarzschild black 8 To learn about	T2,				
4 holes and Kerr solution (rotating black holes) and Schwarzschild	R2				
their astrophysical importance. Experimental tests black holes, 1,2	1				
- Precession of perihelion of Mercury, binary binary pulsars,					
- Precession of perihelion of Mercury, binary pulsars, pulsars, gravitational redshift and bending of light, gravitational					
- Precession of perihelion of Mercury, binary pulsars, pulsars, gravitational redshift and bending of light, gravitational redshift and					
- Precession of perihelion of Mercury, binary pulsars, gravitational redshift and bending of light, gravitational waves binary pulsars, gravitational redshift and bending of light,					
- Precession of perihelion of Mercury, binary pulsars, gravitational redshift and bending of light, gravitational waves  binary pulsars, gravitational gravitational redshift and bending of light, gravitational					
- Precession of perihelion of Mercury, binary pulsars, gravitational redshift and bending of light, gravitational waves  binary pulsars, gravitational redshift and bending of light, gravitational waves.	T2.				
- Precession of perihelion of Mercury, binary pulsars, gravitational redshift and bending of light, gravitational waves  gravitational waves  binary pulsars, gravitational redshift and bending of light, gravitational waves.	T2, R2				

magnitude -redshift relations. Age of the universe.	and Hubble's		
Early universe, inflation. Thermal history of the	law. Friedmann	1,2	
universe: Big Bang Nucleosynthesis, matter	models,		
radiation decoupling, Cosmic Microwave	Singularity.		
Background (CMB). Idea of dark matter and dark	Cosmological		
energy.	parameters,		
	Cosmic		
	Microwave		

#### **Textbooks**

T1: Introduction to relativity - J V Narlikar.T2: Gravitation and Cosmology - S Weinberg.

#### Reference books

R1: Relativity, Gravitation, and Cosmology - T P Cheng

R2: General relativity, astrophysics, and cosmology - Ray Choudhry, Banerji and Banerjee.

#### Other learning resources

https://www.britannica.com/science/general-relativity

#### RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Describe the concept general theory of relativity, principle of equivalence, principle of general congruence.	1, 3			
2	Describe adequate idea on tensors, motion in the gravitational field	1, 3, 4, 7			
3	Verify different types of tensors like covariant, contravariant tensors and metric tensor.	1, 2, 3, 4, 8			
4	Describe the idea on rotating black holes and gravitational waves	1, 2, 3, 8			
5	Describe the Cosmological principle, Big Bang Nucleosynthesis, dark matter and dark energy.	1, 3, 4, 8			

	SEMESTER – IV										
	e Title		Plasma Physics II								
Cours	e code	24MSPH2203R	Total credits: 4		L	T	P	S	R	O/f	C
			Total hours: 60 T		4	0	0	0	0	0	4
		Nil	Co-requisite		Nil						
	equisite	Nil									
	ammes		Master of Science in Physics								
	ester		Spring/IVSemester  . The course will give the comprehensive knowledge on plasma								
	urse		•		•		C .1	1.			
objec	ctives		ables the students to h			anding	of the	appli	ed elect	rodynan	11CS
Cor	ırse		the nature and proper	rues of p	olasma.						
		<ol> <li>Identify the basic concepts of plasma</li> <li>To learn Transport Phenomena in Plasma.</li> </ol>									
oute		_	Kinetic Theory of Plas								
		4. To learn about 1		iiia							
			Plasma Applications								
Cor	ırse		o incorporate introduc	ction to	plasma physi	cs. The	cour	se pro	vides a		
		_	cription on the physics					-		ers and p	lasma
	•	waves.		•			•	-		-	
Text	books	T1: Introduction to	Plasma Physics and C	Controll	ed Fusion: F	F Cher	1				
Refe	rence	R1: Fundamentals	of Plasma Physics: J J	Bitteno	court						
bo	oks	R2: Plasma Physic	s :R J Goldstone and I	P H Rut	nerford						
Other 1	earning	https://www.you	tube.com/playlist?li	st=PLb	MVogVj5nJ9	54KY5	<u>UFWE</u>	3LSu7	<u>kMzPb</u>	L35T	
	urces										
Unit no		Conten	t	СН	Learni Outcome	ng			KL		Ref
1	Review	of basic concepts	of plasma physics:	1	To unders	stand th	ne			T1.	, R1
		•	perature and Debye		basics of pla				1,2		,
	_	-	motion and drifts,		physics						
	Plasma (	Criteria, Plasma app	roximation								
2	Diffusio	n and resistivity	in weakly Ionized	2	To learn	Transp	ort			T1,	, R1
	plasma,	Steady State Soluti	ons, Diffusion across		Phenomena	in Plas	ma		1,2		
	_	netic field, Bol									
	Neoclass	•	, .								
	equilibri										
			bility Analysis, Two-								
		nstability, Gravitatio		2	T- 1-	. <b>h</b> .c				7014	D2
3	Introduc		theory, distribution variables, Boltzmann		To learn a Kinetic Theorem					11,	, R2
3		•	application of Vlasov		Plasma	01 y 01			1,2		
	_	•	Physical derivation of		1 Idollid				1,2		
	_		effects in a magnetic								
	field.		<i>8</i>								
	Introduc	tion, Plasma Shea	th, Langmuir Probe,	3	To learn a	bout				T1.	, R2
4			romotive Force, Ion-		Nonlinear E	ffects					,
	acoustic	Solitary Waves a	nd the Korteweg-de						1,2		
	Vries (	(KdV) Equation,	Sagdeev Potential,								
	Nonline	ar Schrodinger Eq	uation, Modulational								
		ty and Envelope Sol									
			aspects of Plasma		To learn a					T1,	, R2
5	-	-	, Plasma Diagnostic		Plasma App	lication	ıs				
	_	_	e Plasma, Tokamak					1	,2,3		
1	theory, (	Confinement of the I	'lasma.								

T1. Introduction to Plasma Physics and Controlled Fusion: F F Chen.

#### Reference books

R1: Fundamentals of Plasma Physics: J J Bittencourt R2: Plasma Physics: R J Goldstone and P H Rutherford

#### Other learning resources

https://www.youtube.com/playlist?list=PLbMVogVj5nJS4KY5UFWBLSu7kMzPbL35T

#### RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Identify the basic concepts of plasma	1,3			
2	To learn Transport Phenomena in Plasma.	1, 3, 4, 7			
3	To learn about Kinetic Theory of Plasma	1, 2, 3, 4, 8			
4	To learn about Nonlinear Effects	1, 2, 3, 8			
5	To learn about Plasma Applications	1, 3, 4, 8			

SEMESTER – IV									
Course Title		Advanced Molecular Spectroscopy and laser							
Course code	24MSPH2101R	<b>Total Credits: 4</b>	L	T	P	S	R	O/F	С
		Total Hours: 60 T	4	0	0	0	0	0	4
Pre-requisite	Nil	Co-requisite		•		Nil			
Anti-requisite	Nil								
Programmes		Master of Sc	cience in Phy	ysics					
Semester	Spring/III Semester of First Year of the Programme								
<b>Course Objectives</b>	1. Introduction to emission and absorption spectra of the atoms								
	2. Knowledge of different energy levels in atoms and various coupling schemes.								
	3. To know the Born-Oppenheimer Approximation and its application on molecular spectroscopy								
<b>Course Outcomes</b>	1.Identify different energy levels of atoms, frequencies of spectral lines of alkali spectra								
	2.Describe the concepts of Zeeman effect, Paschen Back effect and Stark effect in atomic								
	spectrum.								
	3.Define the concept on molecular spectra.								
	4. Acquire adequat	te idea on Raman Spectroscop	py.						
	5.Define the properties of laser, various types of lasers and their working principles.								
<b>Course Description</b>	The broad object	ive of the course is to prov	ide a knowl	edge	about	the sp	ectra	of aton	ns and
_	molecules and las	ers.				_			
No. 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1									

Other learning resources: http://www.preciousheart.net/chaplaincy/Auditor_Manual/13casesd.pdf

Unit-	Content	СН	Learning Outcome	KL	Ref
No.					
I	Atomic emission and absorption spectra, fine structure of hydrogen atom, spectra of helium and alkali atoms, Lande interval rule, L-S and J-J coupling schemes.	10	To learn about the spectra of Hydrogen and alkali atoms, L-S and J-J coupling schemes	1,2	T1, R1
II	Zeeman effect, Paschen Back effect, Stark effect, Calculation of Zeeman pattern and intensity distribution in complex spectra. Hyperfine structure and determination of nuclear spin. Breadth of spectrum lines: Natural broadening, Doppler broadening, Collision broadening and Stark broadening.	12	To apply knowledge of Zeeman effect for Calculation of Zeeman pattern. To learn about Paschen Back effect, Stark effect, Hyperfine structure and Breadth of spectrum lines	1,2	T1, R1, R4
III	Rotation, vibration and rotation-vibration spectra of diatomic molecules, selection rules. Electronic spectra: Born-Oppenheimer approximation, formation of bands, progressions and sequences of vibrational bands, Intensity distribution, Franck Condon principle	10	To learn about Rotation, vibration and rotation-vibration spectra of diatomic molecules.	1,2	T2, R2
IV	Raman spectra: Classical theory of Raman effect, Vibrational Raman spectrum, selection rules, Stokes and anti Stokes lines, Rotational Raman spectrum, selection rule.	5	To get knowledge of Raman effect and Rotational Raman spectrum	1,2, 3,4	T2, R2
V	Properties of laser light, spontaneous and stimulated emission – Einstein's coefficients, light amplification, population inversion and threshold condition for laser oscillations; optical resonator modes of a rectangular cavity, the quality factor (Q-factor). ammonia maser, Types of lasers: He-Ne laser, semiconductor lasers	10	To learn the applications of laser.	1,2, 3,4	T3, R3

#### **Textbooks**

- T1. Introduction to Atomic Spectra H E White.
- T2. Fundamentals of Molecular Spectroscopy C N Banwell and E M McCash.
- T3. Lasers: Theory and Applications K Thyagarajan and A K Ghatak.

#### Reference books

- R1. Physics of atoms and molecules B H Bransden and C J Joachain
- R2. Spectra of Diatomic Molecules (Vol. 1) G Herzberg.
- R3. Laser Fundamentals: W.T silfvast.
- R4. Atoms, molecules and quanta: A. E. Ruark, HC. Urey.

#### Other learning resources

http://www.preciousheart.net/chaplaincy/Auditor Manual/13casesd.pdf

#### RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

	CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Identify different energy levels of atoms, frequencies of spectral lines of alkali spectra	1, 3			
2	Describe the concepts of Zeeman effect, Paschen Back effect and Stark effect in atomic spectrum.	1, 3, 4, 7			
3	Define the concept on molecular spectra.	1, 2, 3, 4, 8			
4	Acquire adequate idea on Raman Spectroscopy.	1, 2, 3, 8			
5	Define the properties of laser, various types of lasers and their working principles.	1, 3, 4, 8			



## **Assam down town University**

## Curriculum and Syllabus

# Master of Science in Zoology

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.2

### FACULTY OF SCIENCE

July, 2024

**PREAMBLE** 

Assam down town University is a premier higher educational institution which offers Bachelor,

Master, and Ph.D. degree programmes across various faculties. These programmes, collectively

embodies the vision and mission of the university. In keeping with the vision of evolutionary

changes taking place in the educational landscape of the country, the university has restructured

the course curriculum as per the guidelines of National Education Policy 2020. This document

contains outline of teaching and learning framework and complete detailing of the courses. This

document is a guidebook for the students to choose desired courses for completing the

programme and to be eligible for the degree. This volume also includes the prescribed literature,

study materials, texts, and reference books under different courses as guidance for the students to

follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated

16th & 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated

26/07/2024

Chairperson, Board of Studies

Member Secretary, Academic Council

Downey

#### Vision

To become a Globally Recognized University from North Eastern Region of India, dedicated to the Holistic Development of Students and Making Society Better

#### Missions

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving societybetter.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

#### **Programme Details**

#### **Programme Overview**

The Zoology program equips graduates for careers in industry, agriculture, and research. They develop professional, communication, and ethical skills, blending innovation and entrepreneurship for personal and national growth, while remaining responsive to societal needs and committed to lifelong learning. Graduates will identify and analyze biotechnological problems, apply multidisciplinary concepts, and achieve global competency. They gain scientific knowledge, laboratory and analytical skills, and problem-solving abilities in various fields. Proficiency in scientific tools, enhanced communication skills, adherence to professional ethics, and a research-oriented mindset are emphasized. Social and environmental responsibility, promoting sustainability, and contributing to societal development are key outcomes.

The course duration is for a period of 2 years.

#### I. Specific Features of the Curriculum

- Experiential learning
- Constructivist approach to learn
- Practical and project-based learning

#### II. Eligibility Criteria:

BSc in any area of life sciences with minimum of 45% marks or equivalent CGPA.

#### **III. Program Educational Objectives (PEOs):**

**PEO1:** AdtU zoology postgraduates will be well prepared for successful careers in both government & private sectors in one or more of the following areas: ecological, conservation biology, pest, habitat, vector borne disease management and health sciences.

**PEO2:** The postgraduates will be academically prepared to become zoologists in due course and will contribute effectively to the growth and development of in broad field of ecology & life sciences.

**PEO3:** The postgraduates will engage in professional activities to enhance their stature and simultaneously contribute to the profession and society at large and be successful in higher education in zoology in apiculture, ornamental fish farming and health sciences, if pursed.

#### IV. Program Specific Outcomes (PSOs):

**PSO1:** Proficiency in Scientific Knowledge: Apply the skills necessary to address challenges within the domains of zoology and open a multitude of employment opportunities in the relevant field.

**PSO2:** Critical Thinking: Able to promote a multidisciplinary approach for research exploration and collaboration with professionals across diverse disciplines.

**PSO3:** Techno-Professional Competency: Develop capability to cultivate ethical values in professionalism, emphasising integrity, responsibility, continuous learning, and skill refinement in alignment with the latest advancements in zoological science.

#### V. Program Outcome:

**PO1: Disciplinary Knowledge:** Apply comprehensive knowledge of basic sciences, biostatistics, life sciences and specialization in zoological sciences for solving complex health, agricultural, taxonomical and ecological issues.

**PO2: Problem Solving:** Identify, review literature, formulate, analyse and evaluate complex zoological problems using critical thinking.

**PO3: Reasoning and Research:** Recognise the cause and effect, design hypotheses and experiments using modern tools and techniques, analyse and interpret the data to draw reasonable conclusions.

**PO4: Communication:** Communicate efficiently among stakeholders and society at large, and be able to write documents/scientific reports and deliver effective presentations.

**PO5:** Values and Ethics: Comply with human values and ethics and its strict application in the profession.

**PO6:** Environmental Sustainability: Understand the impact of the formulated solutions in socio-environmental context and redesign considering sustainable global development.

**PO7: Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO8:** Lifelong Learning: Ability to engage in independent lifelong learning in the broadest context of scientific advancement.

#### VI. Total Credits to be Earned: 88

#### VII. Career Prospects:

A post Graduate in Zoology can make one attractive to a wide variety of organisations including charities, government agencies, universities, and research centres. They can join pharmaceutical companies, fisheries and sericulture Departments, Zoological Survey of India, Entomologist, Forest Department, Wildlife Institutes and NGO's, Wildlife related Broadcasting Channels, Health Department.

#### **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

#### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting in-semester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks
		Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

#### INSTRUCTION

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

#### **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

#### I. Pre-Examination:

#### Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

#### II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

#### **III. Pattern of Question Papers**:

The question paper shall follow the principles of Bloom's Taxonomy.

Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

#### IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

#### V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

#### VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

#### VII. Instruction to the Students:

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.

- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

#### VIII. Provision for an Amanuensis (writer):

- (i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.
- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

#### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

#### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

**Table 2: Letter Grades and Grade Points** 

Letter Grade	Grade Points	Description
О	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
С	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

#### iv. Grade Point Average:

#### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} c_{i}G_{i}}{\sum_{i=1}^{n} c_{i}}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

#### b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight)of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

#### D. Post-Examination

#### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

#### INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

#### 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.
- b. Inquiry-Based Learning: The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.

- c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.
- d. Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

#### The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the	
presence of teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

#### Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

#### SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title		E	ng	gag	ger	ne	nt			Iaximu Iarks f		
	11.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSZO1101R	Genetics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSZO1102R	Taxonomy and Basic Entomology	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Semester I	3	24MSZO1103R	Biochemistry and Bioinstrumentation	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
	4	24UMFS1101R	Fundamental of Statistics	MDC	1	0	2	0	0	0	2	40	60	100	200
	5	24UMPD1101R	Effective English	AEC	0	0	4	0	0	0	2	0	0	100	100
	6	24UMCC1101	Co-Curricular Activities	Co and Extra-		0	0	0	0	0	1	0	0	100	100
				Curricular											
			Total								17	1			1000
	S.	Course Code	Course Title	Course	E	ng	gag	ger	ne	nt			Iaximı Iarks 1		
	No.			Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	24MSZO1201R	Endocrinology and Immunology	DSC Major			2			_		40	60	100	200
	2	24MSZO1202R	Cell Biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSZO1203R	Molecular Biology, Genomics and Genetic Engineering	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	4	24UMPD1201R	Aptititute / Logical Course	AEC	2	0	0	0	0	0	2	40	60	0	100
Semester II	5	24MSZO1204R	Postgraduate Practice Teaching	SEC	1	0	0	0	0	0	1	0	0	100	100
Se		24MSZO1205R	Research Methodology and Statistical Analysis	Research	2	0	2	0	0	0	3	40	60	100	200
	8	24MSDA1201R	Data Analysis using Microsoft Excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	9	24MSZO1206R	Field Visit	Field Training	0	0	0	0	0	0	1	0	0	100	100
	10	24UMEC1201	Extra-Curricular Activities	Co and Extra-	0	0	0	0	0	0	1	0	0	100	100
				Curricular	L										
			Total								22				1300
														_	

	S. No.	Course Code	Course Title	Course Category	E	ng	gag	gen	ne	nt			Iaximı Iarks 1		
	110.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	24MSZO2101R	Animal Physiology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSZO2102R	Developmental Biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
ır III	3	24MSZO2103R	Evolution and Ecology	DSC Major	2	0	2	0	0	0	3	40	60	100	200
Semester III	4	24MSZO2104R	Aquaculture	DSC Major	2	0	2	0	0	0	3	40	60	100	200
S	5	24MSZO2105R	Internship	Internship	0	0	0	0	0	0	4	0	0	100	100
		24MSZO2106R	Project Dissertation	Research			8				4	0	0	100	100
		24UMPD2101R	· ·	AEC	_		4				2	0	0	100	100
		24MSZO2108R	Field Visit	Field			0				1	40	60	0	100
	8			Training	ľ	ľ									
	9		Indian Knowledge System	VAC	0	0	0	0	0	0	2	0	0	100	100
			Total								27				1300
	S.							l				N		um	
	N.	Course Code	<b>Course Title</b>	Course	E	ng	gaş	gei	ne	nt		N	<b>Iarks</b> 1	for	
				Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1		Entomology I (Insect biology,	DSC											
		24MSZO2201R	Ecology and Pest	Major	2	0	0	0	0	0	2	40	60	0	100
			management)												
	2		Entomology II (Insect	DSC											
		24MSZO2202R	Physiology and Toxicology)	Major	3	0	2	0	0	0	4	40	60	100	200
	3	24MSZO2201R	Fish Biology and Fisheries I (Fish Physiology and Fish culture)	DSC Major	2	0	0	0	0	0	2	40	60	0	100
Semester IV	4	24MSZO2202R	Fish Biology and Fisheries II (Fish reproductive biology, Endocrinology and fish genetics)	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Sel	5	24MSZO2201R	Molecular Cell Biology I	DSC Major	2	0	0	0	0	0	2	40	60	0	100
	6	24MSZO2202R	Molecular Cell Biology II	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	7	24MSZO2201R	Animal Ecology and Wildlife Biology-I	DSC Major	2	0	0	0	0	0	2	40	60	0	100
	8		Animal Ecology and Wildlife	DSC	İ						Ė				
	_	24MSZO2202R	Biology-II	Major	3	0	2	0	0	0	4	40	60	100	200
	9	24MSZO2203R	Research/data analysis/documentation- R4	Research	0	0	24	8	12	0	16	0	0	100	100
			Total								22				400
			Grand Total								88		yamin.		4000

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

			SEME	STER – I								
Course T	itle		TAXONOMY	AND BA	SIC 1	ENTO	MOL	OGY				
Course c	ode	24MSZO111R	<b>Total credits: 4</b>		L	T	P	S	R	O/F		С
			Total hours: 45	T+30P	3	0	2	0	0	0	T	4
Pre-requ	isite	Nil	Co-requis	ite		1		Nil		1		
Program			MASTER C		ICE I	N ZO	OLO	GY				
Semester			Fall/ I semester									
Course		1. To impart the k		<u>-</u>					ssifica	ntion.		
Objective	es	2. To provide the	•	•			_				t.	
		3. To provide s						_				
CO1		Discuss the history										
CO2		Identify various app										
CO3		Describe the collect						of anim	al			
CO4		Identify insect pests										
CO5		Determine the com					aring i	nsects.				
Unit-		Content		Contact				Outco			k	L
No.			•	Hour			8	0 4000				
	Defi	nition and basic Cor	ncepts of		Stı	udents	will a	cquire				
		nomy:	•					arding	the			
I		ory of classification	and its	7		-	-	cept of			1	,2
		ortance Aims and ob				konom		•				
	_	nomy Scope of taxo				•						
		erent approaches in			Stı	Students will be able to apply						
		nportance:	•					applica		-		
II		phological, Embryo	logical,	10			-	aches t			1	,2
	-	ecular, Ecological a	-			adopted in taxonomy for						
	appr				dif	ferent	group	of org	anism	s		
	Natu	re and Characteristi	ics of					ain kno				
		onomic procedures:			on	Differ	ent co	llection	n and			
		onomic procedures:			pre	preservation procedures and						
	•	ervation and process			use	e of ke	ys for	specie	S			
		tification of biologic onomic keys: Differ			ide	entifica	ition.					
		nomic keys, their m			Stı	udents	will a	cquire				
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		ogical nomenclatur pretation and applic										
		ortant rules	ation of									
		nation of scientific 1	names of									
		rent taxa. Regulatio										
		code and code of etl										
		duction to Applied						s to pr		_		
		nomic importance						n intro on and		n		
IV		ey bee, silkworm, la ct pests, vectors of d		8		onomic		on and			1	2
17		quito, fly	nscases.	0		portan					1,2	
		role of insects in	ecosystem as			tomolo						
		ronmental indicator.										

V	Commercial importance of insects and their culture: Honey bee and silk worm (life cycle, by product and commercial method of farming) Role of insects in pest management - Brief about chemical and biological control of insect pest Insects in the service of forensic science (role of insect in solving crime)	10	Students will know about the economic value of insect rearing and different methods of rearing the insects and also regarding different methods of controlling insect pests	1,2
Practical	<ul> <li>Identification and classification of important organisms from different phylum of animal kingdom.</li> <li>Collection, identification and preservation of insects.</li> <li>Permanent slide preparation of mouthparts of mosquito, cockroach, butterfly and honeybee.</li> <li>Study of various types of social insects (honeybee/ants) and their nests.</li> <li>Mounting of legs, antennae and wings (at least of two types).</li> <li>Dissection of sting apparatus in honey bee.</li> </ul>	30		1,2,3,4

- T1: Insect pest management by Dent DR, (latest edition). Westville Publishing House: Delhi
- T2: An ecological and social approach to biological control, Eilenberg J, (latest edition). Springer.
- T3: Theory and Practice of Animal Taxonomy and Biodiversity by Kapoor V C 8Ed. Oxford and IBH publishing.
- T4: The insects: structure and functions by R. F. Chapman (5th Edition). Cambridge University Press.
- T5: Handbook of entomology by T. V Prasad, (4th Edition). New Vishal Publications.

#### **REFERENCE BOOKS:**

- R1: Principles of Animal Taxonomy by G. G. Simpson, (latest edition). Scientific publisher Animal Taxonomy by H. E. Goto (latest Edition). Arnold
- R2: International Code of Zoological Nomenclature official publication
- R3: A Text Book of Fundamental and Applied Entomology by M.S. Ali, S.V.S. Raju and M. Raghuraman Tanweer Alam, (latest edition). Kalyani publisher
- R4: Introduction to general and applied entomology (Scientific Pub.: India) by Awasthi V B (latest Edition). Scientific publishers journal Dept.

#### **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

#### RELATIONSHIP BETWEEN COURSE OUTCOME(CO) AND PROGRAM OUTCOMES

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Discuss the history and concept of taxonomy and its classification.	1, 5, 6
2	Identify various approaches of taxonomy and its importance	1, 3
3	Describe the collection, identification and preservation process of animal	1, 6, 8
4	Identify insect pests and vectors responsible for diseases.	1, 6, 8
5	Determine the commercial value of insects and plan for rearing insects.	1, 8

			STER –							
Course Tit		BIOCHEMISTRY	AND I	BIO	DINSTRU	UME	NTATI	ON		
Course cod	le   24MSZO112R	Total credits: 4		L	T	P	S	R	O/F	C
		Total hours: 45T		3	0	2	0	0	0	4
Pre-requisi	te Nil	Co-requisite					Nil			
Programm	e	MASTER C								
Semester		Fall/ I semester		-						
Course	· ·	nd the fundamentals			_					
Objectives		s. To develop know	ledge an	d ic	dentify th	e cher	nical lo	gic of	bioener	getics
	and metabol	•		1.	. ,.	c 1				1: 0
		owledge of principl	les and a	ppli	ications o	ot anal	ytıcal ı	nstrum	ents in	lite
	sciences.	: .1 :1		_4:	1 .1	4	4: .	CD.	. 4 . •	1
	Nucleic Act	iological samples fo	or purinc	all	on and ci	iaracio	erisano	n oi Pr	otems a	ına
CO1		ncepts of carbohydr	otos lini	de	nuclaio	oids	vitomir	og ond r	ninaral	g
CO2		t of Bioenergetics in								3.
CO ₂		ciples and operation						•		
CO3		orinciples and app								n of
		om biological samp	_	J	.i separe	~v1U11	unu (	. 11 a1 a0 l	-1134110	.1 01
CO5		tography technique		rate	e molecu	les.				
TT 1: N	Cont		Contac				g Outo	ome		KL
Unit-No.			Hour				0			
	Concept of biomole	cules (composition,		5	Students	will 1	earn a	bout		
	structure and function	ons):		ŀ	biomolec	ules, t	heir uni	que		
	<ul> <li>Carbohydrates</li> </ul>			5	structural	chara	cteristi	cs and		
	• Lipids			f	functions					
I	• Nucleic acids		7							1.2
1	• vitamins and mine	erals.	,							1,2
	• Special focus on c	onformation of								
	proteins (level of )	protein								
	organization and I	Ramachandran								
	plot), domains, mo	otif and folds.								
	<b>Bioenergetics:</b>				They wil	-		edge in		
	• Concept of thermo	*			Basics of					
	,	y and free energy)			(Bioener	-				
	• Reaction kinetics				dynamic		-	_		
	phosphorylation a				know ab	out en	zymes	and the	eir	
	phosphorylation, o	-			kinetics					
		biological energy								
тт	transducer).	maga Daffinida	10							1.2
II	Enzymology/Enzy		10							1,2
	and structural org	anization of tion, mechanism of								
	•	d factors affecting								
	*	Salient features of								
	active site.	allolle loutules of								
	• Enzyme regulatio	n and role of								
	inhibitors.	<del>V -</del>								
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Ш	<ul> <li>Metabolism of biomolecules:</li> <li>Carbohydrate metabolism- Glycolysis and its regulation, Gluconeogenesis, Glycogenolysis TCA cycle, Pentose phosphate pathway</li> <li>Lipid metabolism: oxidation of fatty acid and biosynthesis of fatty synthesis. Heme synthesis and degradation.</li> <li>Amino acid metabolism-Transamination, deamination and urea cycle.</li> <li>Nucleotide metabolism - Biosynthesis of purines and pyrimidines by de novo and salvage pathways, inhibitors of nucleotide synthesis, degradation of purines and pyrimidines.</li> </ul>	10	They will be gaining knowledge about carbohydrate metabolism.  Also, they will get to know lipid, protein and nucleic acid metabolism.	1,2
IV	Gel Electrophoresis:  Introduction, principle, types, application. PCR: Introduction, types and application.  Blotting technique: Southern blot, Western Blot and Northern blot, Microscopy:  Introduction, types (light field microscope, dark field microscope, phase contrast microscope, fluorescence microscope, AFM and Electron microscope), and application.  Centrifugation:  Introduction, principle, types of centrifuge and rotors, application of density gradient and analytical centrifugation  Radioactive tracer technology: Principle, measurement and applications in biology	8	Students will understand the Techniques to measure, study And observe Biomolecules like Proteins, DNA,RNA etc. Students will learn Microscopic technique applied to understand cellular ultrastructure and function of genes and proteins. Students will apply the knowledge of radioactive tracer molecule to track down biochemical metabolism and gene expression	1,2
V	Chromatography: Introduction, Principle, Classification, Column Chromatography; Adsorption column chromatography; operational technique, elution procedure, application, Partition chromatography. Thin layer chromatography: Introduction, Principle, technique, application and	10	Students will learn the principle and applications of Chromatography in protein purification, MW determination Students will understand the principle and application of Spectroscopic technique to Gauge conformation and Concentration of biomolecules Students will be able to	1,2

	HPTLC. Rf value. Gas		separate biomolecules from	
	Chromatography		complex mixtures.	
	Ion exchange chromatography: Ion			
	exchange resins, mechanisms,			
	procedure, applications.			
	High Performance liquid			
	chromatography: Introduction,			
	instrumentation, application,			
	advantages. Gel Chromatography:			
	Introduction, Technique,			
	instrumentation, application			
	Spectroscopic techniques: Infra-red			
	Spectrophotometry: Introduction,			
	Instrumentation, application.			
	NMR: Introduction, Principle,			
	Instrumentation, Spin-Spin coupling,			
	application.			
	Mass Spectrometry: Introduction,			
	Principle, Instrumentation,			
	application, UV- Visible			
	spectroscopy, atomic absorption			
	spectroscopy.			
	• Estimation of protein by Lowry's/			
	Bradford method.			
	• Estimation of Glucose by Anthrone			
Practical	method.	30		1,2,3,4
1 i acticai	• Estimation of RNA/ DNA.	30		1,2,5,4
	Achromic point of salivary amylase			
	<ul> <li>Qualitative analysis of protein,</li> </ul>			
	carbohydrate and amino acid			

- T1. "Lehninger Principles of Biochemistry" by David L Nelson and Michael M Cox
- T2. "Biochemistry" by U Satyanaryana and U Chakrapani
- T3. Principles of Biochemical Techniques, 5th edition, Wilson and Walker. Cambridge University Press.
- T4. Modern Biochemistry Laboratory Techniques. 3rd edition. Rodney Boyer. Tata McGraw Hill.

#### **REFERENCE BOOKS:**

- R1: "Haper's Illustrated Biochemistry" by Robert Murray, Daryl K Granner et al.
- R2: "Biochemistry" by Lubert Stryer, Jeremy M Berg, et al.
- R3:"Biochemistry" by David E Metzler.
- R4:Lehninger's Principles of Biochemistry. 4th edition. Nelson and Cox. Prentice Hall.
- R5:Biochemistry, 4th edition. Voet and Voet. Tata McGraw Hill.

#### OTHER LEARNING RESOURCES:

- 1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q.
- 2. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 3.ERP LMS-PRAN

#### RELATIONSHIP BETWEEN COURSE OUTCOME(CO) AND PROGRAM OUTCOMES

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe the concepts of carbohydrates, lipids, nucleic acids, vitamins and minerals.	1
2	Explain concept of Bioenergetics including thermodynamics and enzymology.	1
3	Discuss the principles and operation of instruments for detecting biomolecules.	1, 8
4	Explain the principles and application of separation and characterisation of biomolecules from biological samples.	1, 8
5	Identify chromatography techniques to separate molecules.	1, 8

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III	Human Genetics: Karyotypes, pedigree analysis, LOD score for linkage testing, Chronic myeloid leukaemia, Burkett's lymphoma and retinoblastoma.  Quantitative inheritance: Polygenic inheritance, heritability, QTL mapping. Gene mapping methods: Linkage maps, tetrad analysis, Basic idea of Human Genome Project and Mapping.	10	Learners will be able to understand inherited genetics and diseases associated to gene alteration  Learners would be able to Understand basic concepts of quantitative inheritance, methods of gene mapping and information of human genes	1,2
V	Regulation of Gene Expression: Regulation of gene activity in lac and Btrp operons of E. coli.; General introduction to gene regulation in Beukaryotes at transcriptional and posttranscriptional levels Genetic Engineering: Restrictive enzymes - Recombinant DNA techniques. Applications of Recombinant DNA technology.	10	Students will learn how genes were regulated in prokaryotes and eukaryotes. It will also assist them in understanding genetic engineering and biotechnology	1,2
Practical	<ul> <li>Study of divisional stages in Mitosis using onion root tip.</li> <li>Study of divisional stages in Meiosis using permanent slides of grasshopper's testes.</li> <li>Preparation and mapping of polyethene chromosomes from salivary gland of Chironomus/Drosophila larvae.</li> <li>Preparation of human karyotypes: normal male and female: analysis of common human chromosomal aberrations from the pictures provided.</li> <li>To solve some genetic problems based on pedigree analysis.</li> <li>To solve some genetic problems based on gene interaction.</li> </ul>	30		1,2, 3,4

- T1. Principles of Genetics by Snustad and Simmons (7th Edition) John Wiley and Sons, USA.
- T2. Modern Genetic Analysis: Integrating Genes and Genomes by Griffiths, J.F., Gilbert, M., Lewontin, C. and Miller (2nd Edition) W. H. Freeman and Company, New York, USA.
- T3. Genetics by J. Russell (3rd Edition) Benjamin-Cummings Publishing Company, San Francisco, California, USA.
- T4. Molecular Biology of the Gene by Watson. J.D. Hopkins, N.H.., Roberts, J.W., Steitz, J.A. and Weiner, A.M.1987. W.A. (4th Edition) Benjamin/Cummings Co., New York.
- T5. Recombinant DNA: Genes and Genomics a short course by Watson et al., (3rd Edition) W. H. Freeman and Company, New York, USA.

#### **REFERENCE BOOKS:**

- R1: Principles of Gene Manipulation and Genomics, Primrose by S. B. and Twyman, R.M., (7th Edition), Blackwell Publishing, West Sussex, UK.
- R2: Concepts of genetics by William S Klung (Latest Edition), Benjamin-Cummings Publishing Company
- R3: Genetics by BD Singh (Latest Edition), Kalyani Publishers
- R4: Genetics: Analysis of gene and genetics by Harti and Ruvolu (8th Edition), Laxmi Publications.
- R5: Principles of genetics by Tamarin (Latest Edition), McGraw Hill Education.

#### **OTHER LEARNING RESOURCES:**

- 2.NOC: Human Molecular Genetics: https://nptel.ac.in/courses/102/104/102104052/
- 3. Human gene: https://swayam.gov.in/nd2 cec20 bt17/preview
- 4. Tissue engineering: https://swayam.gov.in/nd1 noc19 bt33/preview
- 5. Genetic Engineering: Theory and Application: https://swayam.gov.in/nd1noc19 bt15/preview.
  - O5. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

#### RELATIONSHIP BETWEEN COURSE OUTCOME(CO) AND PROGRAM OUTCOMES

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe chromatin, chromosomes, heterochromatin and euchromatin.	1, 3						
2	Explain mechanisms of sex determination, dosage compensation in human, Drosophila, and <i>C. Elegans</i> , discuss on structural and numerical aberrations of chromosomes.	1, 3						
3	Apply karyotyping and pedigree method for identification of inheritance patterns in genetic disorders, use logarithm of the odds scores for linkage testing in specific disease contexts.	1, 3, 8						
4	Evaluate polygenic inheritance, heritability through Quantitative Trait Locus mapping, linkage maps, and tetrad analysis, explain Human Genome Project and Mapping.	1, 3, 8						
5	Discuss lac and tryptophan operon concept of gene regulation, in prokaryotes, gene regulation in eukaryotes, explain restrictive enzymes and their role in recombinant DNA techniques.	1, 3						

Course code   24MSZO114R   Total credits: 4	SEMESTER – I												
Total hours: 45T+30P   Total hours: 45T+30P   Total hours: 45T+30P   Total hours: Nil   Co-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Semester   Nil   Semester   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester of first year of the programme   Tall' I semester   Tall	Course Tit	tle											
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To make students understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles	Pre-requis	ite Nil	Co-requisite Nil										
1) To make students understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles   2) To define how the cellular components are used to generate and utilize energy in cells.   3) Familiarize the cellular components underlying mitotic cell division.   CO2	Programm	ie											
Objectives prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles  2) To define how the cellular components are used to generate and utilize energy in cells.  3) Familiarize the cellular components underlying mitotic cell division.  CO1 Explain membrane structure and its functioning.  CO2 Describe structural organization of cell and their roles.  CO3 Illustrate different cell cycle processes.  CO4 Discuss mechanism of cell-to-cell communications.  Co5 Illustrate functions of cells and resulting diseases because their improper functioning.  Co6 Illustrate functions of cells and resulting diseases because their improper functioning.  Co7 Illustrate functions of cells and resulting diseases because their improper functioning.  Co8 Illustrate functions of cells and resulting diseases because their improper functioning.  Co8 Illustrate functions of cells and resulting diseases because their improper functioning.  Co8 Illustrate functions of cells and resulting diseases because their improper functioning.  Co9 Co1 a model membrane, lipid bilayer and membrane purpos, inchannels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes)  Structural organization and function of intracellular organisation and function of intracellular organelles (Cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure and function of cytoskeleton and its role in motility)  Cell Division and Cell Cycle (Mitosis and Meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle)  Cell signaling: (Ligands and their receptors, cell surface receptor, signall transduction and plant two-component systems, light signaling pathways in plants, bacterial chemotaxis and quorum sensing) neurotransmission and its regulation of hematopoiesis, general principles of cell communications  Co1 Ligands and their receptors, signal transduction of hema	Semester		Fall/ I semester of first year of the programme										
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3) Familiarize the cellular components underlying mitotic cell division.   CO1		2) To define ho	2) To define how the cellular components are used to generate and utilize energy in										
Explain membrane structure and its functioning.   CO2			cells.										
CO2   Describe structural organization of cell and their roles.   CO3   Illustrate different cell cycle processes.   CO4   Discuss mechanism of cell-to-cell communications.   CO5   Illustrate functions of cells and resulting diseases because their improper functioning.   Content   Contact Hour			, , ,										
CO3			<u> </u>										
Discuss mechanism of cell-to-cell communications.   CO5				their role	S.								
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Membrane Structure and Function: (Structure of a model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes)  II Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure and function of cytoskeleton and its role in motility)  Cell Division and Cell Cycle (Mitosis and Meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle)  Cell signaling: (Ligands and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling pathways in plants, bacterial chemotaxis and quorum sensing) neurotransmission and its regulation of hematopoiesis, general principles of cell communication; cell adhesion and roles of different adhesion molecules, gap junctions,					_					_			
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different adhesion molecules, gap junctions, communications				4.0									
	V			10						1,2			

- T1. The Cell: A Molecular Approach (7th Edition): Geoffrey M Cooper, Robert E Hausman, Sinauer Publication
- T2. Essential Cell Biology (5th Edition), Alberts, Hopkin, Johnson, Morgan, Raff, Roberts, Walter: W. W. Nortopn & Company
- T3. Cell biology by CB Power (Latest Edition), Himalaya Publishing House.
- T4. Cell biology (cytology, biomolecules and molecular biology), V. K. Agarwal and Dr. P.S. Verma
- T5. Lewin B. et al. (2007). Cells. Jones and Bartlett Publishers

#### **REFERENCE BOOKS:**

- R1: Molecular Biology of the Cell (6th Edition)
- R2: Advanced practical zoology, Dr. P.S. Verma and P. C. Srivastava
- R3: Sharma, V. K. (1991). Techniques in Microscopy and Cell Biology. Tata-McGraw Hill.
- R4: Pollard T.D. and Earnshaw W.C. (2007). Cell Biology. Elsevier.
- R5: Lodish H, Berk A, Lawrence S, et al., Molecular Cell Biology, Freeman WH & Co. New York.

#### **OTHER LEARNING RESOURCES:**

https://www.cellbio.com/education.html

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://www.genome.gov/genetics-glossary/Cell-Membrane

#### RELATIONSHIP BETWEEN COURSE OUTCOME(CO) AND PROGRAM OUTCOME

CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain membrane structure and its functioning.	1,3					
2	Describe structural organization of cell and their roles.	1,3					
3	Illustrate different cell cycle processes.	1,3					
4	Discuss mechanism of cell to cell communications.	1,3					
5	Illustrate functions of cells and resulting diseases because their improper functioning.	1,3					

SEMESTER – I																
Course Title MINI RESEARCH (REVIEW OF LITERATURE- R1)																
Course	e code	24MSZO115R	5R Total credits: 2			L	T	P	S	R	O/F	C				
			Total ho	ours: 60P		0	0	0	4	8	0	2				
Pre-re	quisite	Nil		Co-requisit	e				Ni	l						
Progra	amme		MAS	STER OF	SCIENCI	E IN	ZOO	OLO	GY							
Semes	ter	Fall/ I semester of first year of the programme														
Course	e	1. To make Students familiar with and learn to identify the most relevant textbooks,														
Object	tives	reviews, papers and journals for their research topics.														
		2. To impart kno	owledge o	on how to	critically	rea	d and	d asse	ess res	searcl	h pape	ers and				
		reviews.														
		3. To make studer	nts familia	ar with the	formulation	on o	f rese	arch	work i	n pro	per sc	ientific				
		manner.	manner.													
	<b>O</b> 1	Use of database and libraries for original research, books and other article.														
C	O2	Summarize different types of reviews in the form of analytical and descriptive review.														
C	O3	Identify relevant topic for continuing research and methods of collection including														
		filtering of information.														
C	<b>O4</b>	Analyse the demonstrations and findings made by previous authors and comprehend														
		them.														
C	05	Write a review ex	plaining	the prospec	ets of stud	y ch	osen.									
Unit-		Content		Contact		Le	arnin	ıg Ou	tcom	2		KL				
No.				Hour												
	1	iction, comprehens		Describe				_	in ce	11	1,2					
I		h search engines, s	15	_	organization and functions,											
	of topic				microscopy and structural differences.											
		or reference citation		Describe												
II		nt methods for writ	10	membrane structure, function; cell							1,2					
	citation	itation and references.			organization and the							lved				
					sportation.											
		ection to structure o			scribe, illustrate and explain											
III		and specific featur	chromosomal structure and types.							1,2						
	review															
	Plagiar	rism, ethical issues	in		Describe	e, ill	ustrat	e and	expla	in the	<u> </u>					
IV	writing the review		Describe, illustrate and explain the mechanism of cell-to-cell								1,2					
		,		commun							,-					
	Mappii	ng and selection of	journal		Describe			e and	expla	in the	e cell					
		of specific knowledge of			cycle an				_							
V	_	_	for	10				_				1,2				
	publica						~ 1									
<b>v</b>	_	ine and submission ations	10	some spe	ecifi	c cell	type	S			1,4					

- T1. Conducting Research Literature Reviews by Arlene Fink ISBN: 1412971896 Call Number: Q180.55.M4 F56 2010
- T2. Writing Literature Reviews-4th Ed by Jose L. Galvan ISBN: 1884585868 Call Number: H62 .G35 2009
- T3. **Approaches to Social Research** by Royce A. Singleton; Bruce C. Straits ISBN: 9780195147940 Publication Date: 2004-08-12

#### **REFERENCE BOOKS:**

- R1: Literature Reviews from the Writing Center, The University of North Carolina at Chapel Hill
- R2: Social Work Literature Review Guidelines from OWL Purdue Online Writing Lab
- R3: Article available through PubMed Central® (PMC), "a free archive of biomedical and life sciences journal literature at the U.S. National Institutes of Health's National Library of Medicine (NIH/NLM)."
- R4: Khan, K.S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, 96 (3), 118-121.

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Use of database and libraries for original research, books and other article.	1, 2, 3				
2	Summarize different types of reviews in the form of analytical and descriptive review.	1, 3				
3	Identify relevant topic for continuing research and methods of collection including filtering of information.	1, 2, 3				
4	Analyse the demonstrations and findings made by previous authors and comprehend them.	1,5				
5	Write a review explaining the prospects of study chosen.	1, 5, 8				

		SEME	STER – I								
Course Title		FUNDAN	MENTAL	OF S	TATIS	STICS					
Course code				L	T	P	S	R	O/F	С	
		Total hours: 30	0T+30P	2	0	2	0	0	0	3	
Pre-requisit	e Nil	Co-requis	site				Nil		•	1	
Programme		MASTER (	OF SCIEN	ICE I	N ZO	OLOG	Y				
Semester		Fall/ I semeste	er of first y	year o	f the p	rogra	mme				
Course	1. Help to understar	nd the role of sta	tistics in da	ata an	alysis,	decisio	n-mak	cing, a	nd scie	entific	
Objectives	research										
	2. Introduce studen	-			_					-	
	(mean, median,	mode) and n	neasures o	of dis	spersio	n (rar	ige, v	arianc	e, sta	ndard	
	deviation).							. 11			
	3. Teach students h	ow to summarize	e and preso	ent da	ta effe	ctively	using	tables	, charts	s, and	
601	graphs		1		.1	C 1	.1	4	1.4.		
CO1	Describe statistical including scale of r		sample, co	mpiie,	, ciassi	ry and	cnarac	terize	data		
CO2	Compile and preser		in tabular	and c	ranhic	al forn	and e	vnlair	the		
CO2	descriptive statistic		i III tabulai	anu g	grapine	ai ioiii	i and C	лріан	i tiic		
CO3	Compile and preser		and explain	n it hy	vario	us hiva	riate a	nalvsi	s inclu	ding	
	the predictions/ for		ана ехрин	ii ii oy	vario	us orvu	riate a	ilaly 51.	3, IIICIG	amg	
CO4	Compute probabilit		nts and dist	ributi	ons (ne	ormal.	binom	ial. Po	isson).	son).	
CO5					,						
	_		Explain the methods of hypothesis testing, parametric and non-parametric and to evaluate specific cases.								
Unit-No.	Conte	nt	Contact	;	Lea	rning	Outco	me		KL	
Unit-No.			Contact Hour							KL	
Unit-No.	Statistical Methods: I	Definition and		De	scribe,	illustra	ate and			KL	
Unit-No.	Statistical Methods: I scope of Statistics, co	Definition and oncepts of		De	scribe, l orgar	illustra	ate and	l expla		KL	
	Statistical Methods: I scope of Statistics, co statistical population	Definition and oncepts of and sample.	Hour	De cel fun	scribe, l orgar	illustra	ate and and scopy	l expla			
Unit-No.	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and	Definition and oncepts of and sample.		De cel fun	scribe, l orgar	illustra	ate and and scopy	l expla		<b>KL</b> 1,2	
	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s	Definition and oncepts of and sample. d qualitative, scales of	Hour	De cel fun	scribe, l orgar	illustra	ate and and scopy	l expla			
	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina	Definition and oncepts of and sample. d qualitative, scales of	Hour	De cel fun	scribe, l orgar	illustra	ate and and scopy	l expla			
	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.	Definition and oncepts of and sample. d qualitative, scales of al, ordinal,	Hour	De cel fun stru	scribe, l orgar ections uctural	illustra nization , micro differe	and and scopy ences.	l expla	iin		
	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular	Definition and oncepts of and sample. d qualitative, scales of al, ordinal,	Hour	De cel fun stru	scribe, l orgar actions uctural	illustra nization , micro differe	and scopy ences.	l expla	iin iin		
	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives.	Hour	De cel fun stru	scribe, l orgar actions actural scribe, mbran	illustra nization , micro differe illustra e struct	and scopy ences.	l explaand	iin iin		
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	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram and Measures of Central mathematical and po	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives. Tendency: ssitional.	Hour	De cel fun stru  De me cel pro	scribe, l orgar actions actural scribe, mbran l orgar acteins i	illustra nization , micro differe illustra e struct nization	and scopy ences.	l explaand	iin iin		
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I	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram a Measures of Central mathematical and po Measures of Dispersiquartile deviation, m standard deviation, c variation, skewness a	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives. Tendency: sitional. ion: range, ean deviation, oefficient of and kurtosis aition, scatter	Hour 5	De cel fun stru  De me cel pro tran	scribe, l organ actions actural scribe, mbran l organ ateins in	illustra iization , micro differe illustra e struct nization nvolve ation.	and scopy ences.  The and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the	l expla and l expla inction ne	nin n;	1,2	
I	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram and Measures of Central mathematical and po Measures of Dispersiquartile deviation, m standard deviation, c variation, skewness a Bivariate data: Defin	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives. Tendency: sitional. ion: range, ean deviation, oefficient of and kurtosis aition, scatter tial and multiple	Hour 5	De cel fun stru  De me cel pro tran	scribe, actions actural scribe, mbran l organ teins insporta	illustra nization , micro differe illustra e struct nization nvolve ation.	and scopy ences.  The and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the	l expla and l expla inction ne	nin n;	1,2	
I	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram and Measures of Central mathematical and po Measures of Dispersi quartile deviation, m standard deviation, c variation, skewness a Bivariate data: Defin diagram, simple, part correlation (3 variable correlation. Simple lies	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives. Tendency: sitional. ion: range, ean deviation, oefficient of and kurtosis attion, scatter tial and multiple les only), rank inear regression,	Hour 5	De cel fun stru  De me cel pro tran	scribe, actions actural scribe, mbran l organ teins insporta	illustra nization , micro differe illustra e struct nization nvolve ation.	and scopy ences.  The and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the	l expla and l expla inction ne	nin n;	1,2	
I	Statistical Methods: I scope of Statistics, co statistical population Data: quantitative and attributes, variables, s measurement nomina interval and ratio.  Presentation: tabular including histogram a Measures of Central mathematical and po Measures of Dispersiquartile deviation, m standard deviation, c variation, skewness a Bivariate data: Defin diagram, simple, part correlation (3 variable)	Definition and oncepts of and sample. d qualitative, scales of al, ordinal, and graphical, and ogives. Tendency: sitional. ion: range, ean deviation, oefficient of and kurtosis attion, scatter tial and multiple les only), rank inear regression,	Hour 5	De cel fun stru  De me cel pro tran	scribe, actions actural scribe, mbran l organ teins insporta	illustra nization , micro differe illustra e struct nization nvolve ation.	and scopy ences.  The and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the and the	l expla and l expla inction ne	nin n;	1,2	

IV	Random experiment: trial, sample point and sample space, event, Operations of Events, concepts of mutually exclusive and exhaustive events. Definition of probability: classical and relative frequency approach. Discrete probability space, Properties of probability, Independence of events, Conditional probability, total and compound probability rules, Normal probability Distribution, Bionomial probability Distribution, Poisson Probability Distribution, Bayes' theorem and its applications.	8	Describe, illustrate and explain the mechanism of cell to cell communication	1,2,3
V	Testing of hypothesis, parametric test: t-test, z-test, chi-square test. Non-Parametric test: One sample Kolmogorov test, wilcoxon Signed test, Mann-Whitney Test, Kruskal walis test	7	Describe, illustrate and explain the cell cycle and division in general and in some specific cell types	1,2,3
Practical	1. Introduction to R - A programming language and environment for data analysis and graphics. Syntax of R expressions: Vectors and assignment, vector arithmetic, generating regular sequence, logical vector, character vectors, Index vectors; selecting and modifying subsets of data set  2. Data objects: Basic data objects, matrices, partition of matrices, arrays, lists, creating and using these objects; Functions- Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames, combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3. Importing data files: import. Data function, read. table function; Exporting data: export. Data function, cat, write, and write. table functions, function, formatting output - options, and format functions; Exporting graphs -export. Graph function. Graphics in R: creating graphs using plot function,	30	Describe, illustrate and explain and apply staining techniques and carry out microscopic examination.	1,2,3,4

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe statistical population and sample, compile, classify	1.2				
1	and characterize data including scale of measurement.	1, 2				
2	Compile and present univariate data in tabular and graphical	1, 2, 3				
	form and explain the descriptive statistics.	1, 2, 3				
3	Compile and present bivariate data and explain it by various	1, 2				
3	bivariate analysis, including the predictions/ forecasting.	1, 2				
4	Compute probability including events and distributions	1.2				
4	(normal, binomial, Poisson).	1, 2				
5	Explain the methods of hypothesis testing, parametric and	1 2 2 8				
3	non-parametric and use them to evaluate specific cases.	1, 2, 3, 8				

		SEMESTE	ZR – I							
Course Tit	de EFFECTIVE	ENGLISH (COMM	IUNICAT	IVE EN	GLIS	H &	SOF	T SKIL	LS)	
Course coo	de 24UMPD111R	<b>Total credits: 4</b>	L	T   1	P .	8	R	O/F	С	
		Total hours: 60P	0	0 4	4 (	)	0	0	2	
Pre-requis	ite Nil	Co-requisite				Nil				
Programm	ie	MASTER OF S	SCIENCE	IN ZOC	LOG	Y				
Semester		Fall/ I semester of	first year	of the p	rogra	mm	e			
Course	To introduce the state of	ne types of sentences a	nd their sign	nificance.	•					
Objectives	2. To strengthen t	he students' vocabulary	y to enhance	their spe	aking	and v	vritin	g skills.		
	3. To familiarize	the students with the in	nportance of	dress co	des in	vario	ous or	ganizatio	ns.	
CO1	This course will en	nable students to analysi	is and identi	fy the dif	ferent	type	s of s	sentences.		
CO2	Learners will be a	able to integrate the sk	cills of reac	ling and	speak	ing i	n pro	fessional	-	
	communication.									
CO3	Dress code Etique	tte sessions will boost t	heir confide	nce and	morals					
CO4	Students will learn	about the effective and	l efficient ut	tilization	of time	e.				
CO5	Introduction to Pho	onetics and its importan	nce will imp	rove the	learner	s' pr	onun	ciation		
Unit-No	o. Co	ntent	Contact	L	earnii	ng O	utco	me	KL	
			Hour							
	Grammar			Identify and understand the						
	i. Interchange of Inter	Interchange of Interrogative and			structure of interrogative and					
	Assertive Sentences, E	ssertive Sentences, Exclamatory and			assertive sentences.					
	Assertive Sentences	ssertive Sentences			Transform and enhance					
I	ii. Types of Tenses				grammatical accuracy and sentence formation skills.					
	iii. Common Errors				sentence formation skins.					
	iv. Synonyms	Antonyms Homonyms								
	v. Antonyms									
	vi. Homonyms									
	_	Reading Skills			•	_		or faster		
	i. Techniques of Effec	•		reading	_	wit		better		
II	_	Gathering ideas and information from				comprehension and impression the ability to recall a				
	1	ext The SQ3R Technique Interpret the			•			ormation	1,2	
	text	rt				y.	11110	Jillation		
	Listening Skills							damental		
	i. What is listening?			_			_	ance of	1	
	ii. The Process of Lis	-		enhanc	-			nelps to and		
***		i. Factors that adversely affect Listening				_		inication		
III	iv. Difference between	n Listening and	10	_				skills.	1,2	
	Hearing,	, crec .		) prac		, 1150		5 211110.		
	v. Purpose and Impor	tance of Effective								
	Listening	istonina Duosee								
	vi. How to Improve L	istening Process								

IV	i. Definition ii. Type of Conflict Management iii. Effects of Conflict Management iv. Methods to deal with Conflicts (Negative)	8	Learn strategies to manage and resolve conflicts effectively to encourage a positive environment by turning conflicts into opportunities for growth.	1,2
V	Time-Management Skills i. Introduction to Time Management, ii. Purpose and Importance of Time Management, iii. Basic Tips to Maintain Time.	10	Enhance productivity and stress management through effective time allocation and planning. It helps to understand the importance of time management in achieving personal and professional goals.	1,2
Practical	Activity: Problem solving activity: A situation will be given to the students and they will have to tell us how to handle the situation or solve the problem.	30		1,2, 3,4

#### **Text Books:**

- T1: Wren,P.C and Martin,H. 1995. *High School English Grammar and Composition*, S Chand Publishing.
- T2: English Grammar in Use, Raymond Murphy 4th edition, CUP.
- T3: Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

### **Reference Books:**

- R1: English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- R2: Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

### **Other Learning Resources:**

https://www.classcentral.com/report/toefl-preparation/https://brightlinkprep.com/10-best-toefl-prep-books/

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	This course will enable students to analysis and identify the different types of sentences.	1				
2	Learners will be able to integrate the skills of reading and speaking in professional communication.	1, 2				
3	Dress code Etiquette sessions will boost their confidence and morals.	1,8				
4	Students will learn about the effective and efficient utilization of time.	1,8				
5	Introduction to Phonetics and its importance will improve the learners' pronunciation	1, 8				

			SEMESTER -	- II								
Course Ti	itle		ENDOCRINOLOG	Y AND I	MMUNC	LOG	Y					
Course co	de	24MSZO121R	<b>Total credits: 4</b>	L	T P	S	R	O/F	C			
			Total hours: 45T+30P	3	0 2	0	0	0	4			
Pre-requi	site	Nil	Co-requisite			Ni	il					
Programi	ne		MASTER OF SC	IENCE I	N ZOOL	OGY						
Semester			Fall/ I semester of fin									
Course			nd the nature, function		•			•				
Objective	S		s and its connections to				glan	ds, hypo	physis,			
			thyroid, adrenal, pancreas									
			zes students with invert	ebrate en	docrine	systen	ns for	applica	tion in			
			s like pest control.				20		0.1			
			dents about immunology					-				
		· ·	tem including types of	cells inve	olved, ac	quirec	i, inna	ite imm	unities,			
CO1			and immunoglobulins.	41		11	1.1	41				
CO1		classification of	s endocrine glands and	ineir fu	ncuons 1	nciudi	ng bi	osyntnes	as and			
CO2			rine, hypothalamus and th	eir functi	one inclu	ling ir	wertek	rate hor	mones			
CO ₂								nate non	mones.			
CO4			Explain the types of immunity including functions of immune cells.  Describe immunogens, properties, structure and functions including factors affecting									
04		antigenicity.										
CO5		Identify various immunoglobulins, their processing, presenting, activation and										
		differentiation.										
Unit-		Со	ntent	Contact	Lear	ning	Outco	me	KL			
No.				Hour								
	End	ocrine glands, the	ir hormones and		To gain	basic	know	ledge				
I		•	thesis, storage and	7	and und	erstan	ding o	f	1,2			
1	mec	hanism of action	of protein and steroid	,	endocri	_	nds an	d	1,2			
		nones.			hormones							
			ocrine hypothalamus To unders									
		tuitary, Thyroid,			of y diff		_	and				
		rathyroid,			how the			41				
II		ncreas,		10	regulate			1	1,2			
			ructure, secretions and		metabol other fu	-		1				
		nctions of each g			body.	пспоп	15 01 11.					
			nes and their functions.		·	1.1		1				
	~ ~	es of immunity:	1: ', ' 1		Underst			_				
		nate and acquire tive immunity;	d immunity; passive and		system which h		-					
		• ,	madiated immunity		pathoge	•	_	•				
III			mediated immunity.	10	to keep				1,2			
		~	system: Primary and		то кеср	00	ay iic	.1111y				
		condary lymphoi	a organs.  nmune cells: types and									
		oduction.	mune cens. types and									
	þı	oduciioii.										

	Immunogens (Antigens)		To understand and analyse				
IV	General properties, Structure and function,		the knowledge gained on				
	Factors affecting antigenicity	8	nature of immunogens.	1,2			
	Epitopes and Haptens	0	How vaccines are produced	1,2			
	Adjuvants		by knowing the antigenicity				
			factors				
	Immunoglobulins (antibodies)		To understand the				
	General Properties- Structure and functions		importance of antibodies in				
	• Different classes of immunoglobulins (IgA,		immune response, the				
	IgD, IgE, IgG and IgM)		functions of major immune				
V	• Antigen-antibody interactions: Primary and secondary immune responses	10	cells and how the activation	1,2			
	Major Histocompatibility Complex (MHC),		of these cells is done.				
	antigen processing and presentation,		Studying about how				
	activation and differentiation of B and T		scientist created vaccine				
	cells, B and T cell receptors.		against Covid 19 virus				
	Histology of various endocrine glands of						
	vertebrates.						
	• Study of various endocrine glands using						
	models and charts and computer software.						
	• Study of thyroxine and iodine solution in						
	amphibian metamorphosis.						
	• Estimation of urea and uric acid.						
	• Blood glucose – Oral Glucose Tolerance						
Practical	Test.	30		1,2,3,4			
Tractical	• Study of different types of cells in the blood	30		1,2,5,4			
	of human beings.						
	Hemagglutination assay for ABO blood						
	groups.						
	Total Leucocyte count.						
	Differential Leucocyte Count.						
	• 3D structural organization of various						
	antibodies using bioinformatics and online						
	resources.						

- T1. Endocrinology by Hadley Mac E and John Levine(sixth edition) Pears
- T2. Yadav, Textbook of Endocrinology, 2009, Sonali Publications, New Delhi
- T3. Williams Textbook of Endocrinology,14th edition 2019, Elsevier publications Company, Philadelphia
- T4. George Griffin, Endocrinology, 2015, Star pearls publishing, USA
- T5. DeGroot's Endocrinology,8th edition 2 volume set, Elsevier
- T6. Elements of Immunology: F.H. Khan Pearson Education

#### **REFERENCE BOOKS:**

- 1. Vertebrate Endocrinology by O Davis, O Norris (6th Edition). Elsevier Science Publishing Co Inc.
- 2. Williams Text book of Endocrinology (14th Edition). Elsevier.
- 3. An introduction to Comparative. Endocrinology by Barrington, E.E.W (Latest Edition). Clarendon Press
- 4. Kuby Immunology (8th Edition) W.F.Freeman, U.S.A.
- 5. Fundamentals of Immunology by W. Paul (7th Edition). Wolters Kluwer | Lippincott Williams and Wilkins.

### **OTHER LEARNING RESOURCES:**

- 1. Endocrinology: <a href="https://www.classcentral.com/course/swayam-endocrinology-19855">https://www.classcentral.com/course/swayam-endocrinology-19855</a>
- 2. Immunology: https://www.classcentral.com/course/swayam-immunology-14117
- 3. Immunology: https://swayam.gov.in/nd2 cec20 bt05/preview
- 4. Fundamentals of Immunology:
- 5. https://www.classcentral.com/course/immunologyfundamentalsimmunitybcells-12724
- 6. Monoclonal Antibodies:
- 7. https://www.coursera.org/lecture/immunologyfundamentalsimmunitybcells/monoclonalantibo dies-KxBvo

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Identify various endocrine glands and their functions including	1				
	biosynthesis and classification of hormones.					
2	Describe endocrine, hypothalamus and their functions	1, 2				
	including invertebrate hormones.					
3	Explain the types of immunity including functions of immune	1, 2				
	cells.					
4	Describe immunogens, properties, structure and functions	1				
	including factors affecting antigenicity.					
5	Identify various immunoglobulins, their processing, presenting,	1, 2				
	activation and differentiation.					

		SEMESTER -	- II								
Course Tit	de MOLECULA	AR BIOLOGY, GENO	MICS AN	D GEN	ETI	C EN	IGIN	IEER	ING		
Course coo	de 24MSZO122R	Total credits: 4	]	LT	P	S	R	O/F	С		
	'	3 0	2	0	0	0	4				
Pre-requis	ite Nil	Co-requisite				N	il				
Programm	ie	MASTER OF SCI									
Semester		Fall/ I semester of fir	•								
Course	1	oth about genome and its	_		•						
Objectives		entral dogma of life (repl modifications) with the l					atıon	and p	ost		
	_	ower point presentation/s	_		_		th 11t1	most			
	attention.	ower point presentations	ciiiiiai/as	Siginiic.	iit) ai	iu wi	iii uii	inost			
		cs like mutation, DNA da	amage and	repair	are ex	xplai	ned.				
CO1		es, genome, proteome and		_							
CO2	Explain the cent	ral dogma including geno	ome expre	ssion.							
CO3	Illustrate genome	e sequencing, chromoson	ne paintin	g and go	enom	e ma	pping	g.			
CO4		utation and repair mecha-	nisms.								
CO5	Describe genetic										
Unit-No.	Co	ontent	Contact	Lea	arnin	g Oı	ıtcon	ne	KL		
	T . 1	1 0 0	Hour	т.	1 .						
	Introduction to genor			Introductory							
I	genome, proteome an	7	knowledge and refreshing the existing				1,2				
					erstan	-	-				
	The central dogma:	central dogma: transcription,			encin		hniq	ues			
	translation, replication	on, post-		_	tail fo	_	_				
	transcriptional modif			linka	linkage mapping						
II	binding proteins in g	10						1,2			
	nucleosome modific										
	expression, histone										
	acetylation  Mapping of genomes	s basics of genome		Evnl	ain w	zhv. a	man	ic			
	sequencing, shotgun					-	_	15			
III	Euchromatin and het		10	an important aid to genome sequencing					1,2		
	chromosome paintin	•					υ				
	Accessing the genon	<del>-</del>		Geno	ome o	rgan	isatio	n			
	painting, nucleosome				scusse			1			
	and genome express			1	vario	_					
IV	chromosome paintin	•	8		lation				1,2		
	_	modifications and genome expression,				ı regi	ılator	У			
	histone modificatio Mutations and DNA		mech	nanisı	ns						
	Introduction to gene			Kno	wledg	re on	DN/	1			
	Different DNA man				_			•			
$\mathbf{V}$	methods for isolating		10		pulat		_		1,2		
•	bacteria, plant and a		10	reco	mbina	ant D	NA				
	vectors, DNA librari	•		techi	nolog	у					
	genetic engineering										

Practical	<ul> <li>Isolation of genomic DNA.</li> <li>Isolation of plasmid DNA.</li> <li>Polymerase chain reaction.</li> <li>Endonuclease digestion of DNA and analysis of DNA fragments by agarose electrophoresis.</li> </ul>	30		1,2,3,4	
-----------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----	--	---------	--

- T1. The Molecular Biology of the Gene by J. D. Watson et al. (1987) Benjamin Cummings.
- T2. Cell and Molecular Biology, Lohar (Prakash S), 1st Edition, Mjp Publishers
- T3. Cell and Molecular Biology: Concepts and Experiments. Carp Gerald, 1996. John Wiley & Sons Publishers.
- T4. Lodish H, Berk A, Lawrence S, et al., Molecular Cell Biology, Freeman WH & Co. New York.
- T5. De Robertis EDP and De Robertis EMF, Cell and Molecular Biology Saunders College, Philadelphia Dowben RM, Cell Biology, Harper and Row Publ. London.

#### **REFERENCE BOOKS:**

- R1: The Molecular Biology of the Cell by Alberts et al. (1991).
- R2: Gene V by B. Lewin (1994) Oxford University Press, Oxford.
- R3: Molecular cell biology by Lodish et al. (1995) Scientific American press.
- R4: Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell, Taylor & Francis Group, New York, USA.
- R5: Gerald Karpgen, 1999. *Cell and Molecular Biology*, Concepts & Epts. Sec. edn. John Wiley & Sons, Inc., New York.

#### OTHER LEARNING RESOURCES:

- 1. https://in.coursera.org/courses?query=molecular%20biology
- 2. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Discuss genomics, genome, proteome and transcriptome.	1						
2	Explain the central dogma including genome expression.	1, 2						
3	Illustrate genome sequencing, chromosome painting and	1, 2						
	genome mapping.							
4	Explain DNA mutation and repair mechanisms.	1, 2						
5	Describe genetic engineering.	1						

SEMESTER – II											
Course Ti											
Course co	de 24MSZO123R	Total credits: 4	L	T	P	S	R	O/F	C		
		Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requi	site Nil	Co-requisite				Nil					
Programm	ne	MASTER OF SCIE	ENCE :	IN Z(	OOLOG	Y					
Semester		Fall/ I semester of firs	t year	of the	progra	mme					
Course	1. To sensitize th	ne candidates with various a	spects	on ev	olutiona	ry biol	ogy, va	rious			
Objective	s theories relate	d to evolution, patterns of b	ehavio	ur an	d biologi	ical cor	nmunio	ations	S.		
	2. To provide ba	sic and advanced information	on on p	opula	ition and	comm	unity e	cology	y and		
	the immensely	fascinating world of biodi	versity	and v	vildlife.						
	3. To give advan	ced information on conserv	ation b	oiolog	y.						
CO1	Explain the theor										
CO2	Describe populat	ion genetics and phenomer	on, me	chani	sm, laws	associ	ated w	ith it.			
CO3	Explain populati	on and community ecology	•								
CO4		ting mechanisms of an ecos	•								
CO5	Describe biodive	rsity, conservation and man	nageme	nt inc	luding c	ase stu	dies of	Indiar	ı		
	origin										
Unit-		Content	Con	tact	Learn	ing Ou	tcome	K	L		
No.			Но	ur							
	Darwinism				Studen						
	• Concepts of variation	oncepts of variation,				and the					
	Adaptation, struggle	daptation, struggle, fitness and natural			theorie	s of evo	olution				
	selection										
I	Mendelism							1	,2		
	Spontaneity of mut	pontaneity of mutations									
	The evolutionary sy	he evolutionary synthesis.									
	• Concepts of neutra	oncepts of neutral evolution, molecular									
	divergence and mol	ivergence and molecular clocks									
	<b>Population genetics</b>		Students will acquire								
	• Populations			knowledge on							
	• Gene pool, Gene fr				populat	_	netics				
	Hardy-Weinberg L				and var	rious					
	• Concepts and rate of frequency through				behavio	our sho	wn by				
	Migration and rand				organis	ms					
	Adaptive radiation	som genevie univ									
		ns Speciation, Allopatricity									
	and Sympatricity										
II	Convergent evoluti	on	1	0				1	,2		
	<ul> <li>Sexual selection</li> </ul>										
	• Co-evolution										
		Altruism and evolution- Group selection									
	• Kin selection										
	<ul><li>Reciprocal altruism</li><li>Biological clocks</li></ul>	l									
	<ul><li>Development of be</li></ul>	havior									
	Social communicat										
	Social dominance										
	• Use of space and te	rritoriality									
	Population ecology	•		_	Studen	ts will s	gain				
III	• Characteristics and	size of a population	1	0	knowle			$\perp$ 1	,2		

1,2
1,2
1,2
1,2,3,4

- T1. Behaviour, development and Evolution by Patrick Batesson (Latest Edition). Open book publishers.
- T2. Biodiversity by Wilson, E.O (Latest Edition). Academic Press, Washington.
- T3. The Biology of Biodiversity by Kato (Latest Edition). M. Springer.
- T4. Wildlife in India by V.B. Saharia Natraj Publishers (Latest Edition) Dehradun.

- T5. The Wildlife of India by E.P. Gee (Latest Edition). Harper Collins India.
- T6. Environmental Biology- K.C. Agrawal (Latest Edition). Agro Botanical Publishers
- T7. Ecology and Environment- P.D (Latest Edition). Sharma Rastogi Publications.
- T8. Ecology by Krebs, C. J. (6th Edition). Benjamin Cummings.
- T9. Fundamentals of Ecology by Odum, E.P (5th Edition). Cengage Learning India
- T10. Ecology and field biology by Smith and Smith (6th Edition). Benjamin-Cummings.

#### **REFERENCE BOOKS:**

- R1: Genetics and Origin of Species by Dobzhansky, (Latest Edition). Columbia University press
- R2: Evolution by Dobzhansky, Th. F.J.Ayala, I.L. Stebbines and J.M. valentine (Latest Edition). Surject Publication, Delhi.
- R3: Species Evolution-The role of chromosomal Change by King, M. (Latest Edition). The Cambridge University Press, Cambridge.
- R4: Evolution and genetics by Merrel, D. J. (Latest Edition). Holt, Rinchart and Winston, Inc.
- R5: Animal Behaviour by M. P. Arora (Latest Edition). Himalaya Pub. House-New Delhi.
- R6: Organic Evolution (Evolutionary Biology) by Veer Bala Rastogi (13th Edition). Medtech
- R7: Animal Behaviour by Dustin R. Rubenstein (Eleventh Edition). Sinauer Associates Inc.
- R8: Evolution and behaviour by Workman Lance (Latest Edition). Taylor and Francis Ltd.
- R9: Ecological Concepts by Cherrett (Latest Edition) Blackwell Science Oxford, U.K.

### **OTHER LEARNING RESOURCES:**

1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the theories of evolution.	1						
2	Describe population genetics and phenomenon, mechanism, laws associated with it.	1, 2						
3	Explain population and community ecology.	1, 2, 8						
4	Discuss the working mechanisms of an ecosystem.	1, 8						
5	Describe biodiversity, conservation and management including case studies of Indian origin	1, 8						

			SEM	ESTER – I	Ι											
Course	Title	AP	ICULTURE (1	TECHNO 1	PROF	ESSI	ONA	L S	KII	L - I)	)					
Course	code	24MSZO124R	Total credits:	2	L	T	P		S	R	C	)/F		C		
			Total hours:	60P	0	0	4		0	0		0		2		
Pre-rec	quisite	Nil	Co-requ	isite					Nil	•						
Progra	Programme MASTER OF SCIENCE IN ZOOLOGY															
Semest	er		Fall/ I semes	ter of first	year	of the	prog	rai	nme	•						
Course	;	1. To Understand												nd		
Objecti	Objectives demonstrate the use of different equipment for effective bee rearing and color								lony							
		management.  2. To Develop ar	nd implement se	oconol mor	nagam	ant str	ntagi	ac f	or h	onovb		20101	110	G		
			ning for sustain									COIOI	пС	5,		
		3. To Identify an														
			ffective techniq													
C	01	Explain historica			identi	ify sp	ecies	of	hon	eybee	s, a	and 1	ıse	of		
		different equipme														
CC		Demonstrate bee														
CC		Analyse and imp							•							
CC		Plan honey produ		_	_				hon	ey pro	oduc	ction	•			
CO	)5	Identify enemies	and diseases of		s and c											
Unit-		Content		Contact		Le	arnin	ıg (	g Outcome							
No.	T .	1		Hour	G. 1		.11.1	1	1 .	1	• .	.1				
	l	duction to apicultur			ents w ortance					ıın t	the					
_	and his	•			ulture,								1 0			
I		Ferent species of ho	15		ies of					escr	ibe		1,2			
	• Bee	keeping equipmen		the e	ssenti	al equ			ent used in							
						eeping										
	l	ling of a honey bee		Stud		will		be	abl		to					
		nance of apiary rec		demonstrate the proper handling of a honey bee colony, maintain												
II		ction and preserva	15	1												
II	pasture				rate ctively	•	•									
					are t				-							
				_	eeping				Susia	ша	UIC					
	• Seaso	onal management o	f honey has			ents v	_			hone	_V 1	hee				
	colonie	-	1 Honey occ		1	nies s										
		ellaneous managen	nent						•	•						
III	l	ng, uniting, queen		1 10 1					_	_		]	1,2			
	1 '	mentary feeding, sl	-			essing			_		_					
	_ ^ ^	es, robbing, abscon	Č			J		U								
		pulations for honey			Stud	ents	will	0	ptin	nize	hor	ney				
		omics of beekeepir	-			uction			•	tand		the				
IV		n rearing	8	10	econ	omics	of	b	eeke	eping	, 8	and	1	1,2		
	2,500	· <b>&gt;</b>				y tec						sful				
					quee	n rear	ing.									
	• Fami	liarization with ene	emies of	Students will identify common						non						
	honey	bees and their cont	rol		enen	nies a	and o	dise	eases	of	hor	•				
V	• Fami	liarization with dis	eases	10	bees	and	im	ple	men	t ef	fect	ive	1,2			
	of hone	ey bees and their co		conti		measi	ure	S	to 1	prot	tect	•				
					colo	nies.										

- T1: Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- T2: Sardar Singh, Beekeeping in India. ICAR, New Delhi.
- T3: Principles of Insect Physiology by V.B. Wigglesworth, 1972, Springer
- T4: Fundamentals of Entomology by Richard J. Elzinga, 2003, Pearson
- T5: Hand book of Economic Entomology for South India by Ayyar, T.V.R, 1992, Narendra Publishing House, New Delhi

# REFERENCE BOOKS

- R1: Bisht D.S., Apiculture, ICAR Publication.
- R2: Entomophagous Insect by Curtis Paul Clausen, 2010, McGraw-Hill book Company
- R3: Insect and hygiene by Busvine, J.R. 1951, Published by Methuen & Co, London
- R4: The Insects Structure and Function by R.F. Chapman, 2012, Cambridge University Press.
- R5: Principles of Insect Physiology by V.B. Wigglesworth, 1972, Springer

## OTHER LEARNING RESOURCES:

- 1. ERP notes
- 2. Online study materials

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain historical evolution of apiculture, identify species of honeybees, and use of different equipments for bee rearing.	- 16X						
2	Demonstrate bee colony handling techniques maintaining apiary records.	1, 6, 8						
3	Analyse and implement seasonal management strategies for honey bee colonies.	1, 6, 7, 8						
4	Plan honey production and exhibit queen rearing for sustainable honey production.	1, 6, 7, 8						
5	Identify enemies and diseases of honey bees and control them.	1, 6, 8						

SEMESTER – II												
<b>Course Tit</b>	le MIN	NI-RESE	ARCH (RE	SEARCH	GAI	ANA	LYS	IS - R	(2)			
Course cod	le 24MSZO125R	Total ci	redits: 2		L	T	P	S	R	O/F	С	
		Total h	ours: 60P		0	0	4	0	0	0	2	
Pre-requisi	ite Nil		Co-requisit	te				Nil			•	
Programm	e	MA	STER OF S	CIENCE 1	IN Z	OOL	OGY					
Semester			semester of									
Course	To determine whet		•		iterat	ure ga	p ana	lysis l	nave b	een m	et, if	
Objectives	not what steps can											
CO1	Create and implem			he gap								
CO2	Find the gap and e											
CO3	Identify the ideal f											
CO4	To analyse the cur											
	CO5 To implement the strategies to meet the research gap under supervision.											
Unit-No.	Unit-No. Content Contact Learning Outcome							]	KL			
			Hour									
	What is literature rev	riew.	Identify literary techniques and creative									
I					uses of language in literary texts.  Adapt their texts to particular						1,2	
											,	
				audiences								
II	How to Begin the lite	rature	10	Adapt their texts to particular							1,2	
	Review			audiences								
	How to write main bo	ody of	4.0	The stude								
III	literature review		10	importance			al cons	siderat	10n 1n		1,2	
	research writing  How to write conclusion  The students will be able to select one											
13.7	How to write conclusi	on	1.5								1.2	
IV	of literature Review		15	of the ma	-	-	_		ariabl	es	1,2	
	II4			from the				_		<b>#</b> 2		
V	How to analyze gap		10	The stude							1 2	
v	in literature review.		10		ing research papers in proper ormat and styles.					er	1,2	
				AFA IOII	mat d	nu sty.	105.					

1. Multiple Stressors: Literature Review and Gap Analysis (WERF Research Report Series) by S.M. Swanson.

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Create and implement a plan to bridge the gap	1, 2, 3						
2	Find the gap and evaluate solutions.	2, 3						
3	Identify the ideal future state/action plan	2, 3						
4	To analyse the current state/work of research	2, 3						
5	To implement the strategies to meet the research gap under supervision.	2, 3, 8						

SEMESTER – II												
	urse Title RESEARCH METHODOLOGY AND STATISTICAL ANALYSIS											
Course	code	24UMRM121R	Total credits: 2		L	T	P	S	R	O/F	C	
		2-11	Total hours: 15T + 60	)S	1	0	0	4	0	0	2	
	Pre-requisite Nil Co-requisite Nil											
Progran			MASTER OF SCII									
Semeste	r		Fall/ I semester of firs									
Course			s to enhances the student					_				
Objectiv	ves		ncluding theory of science	ce and qu	ıalıt	ative a	and q	uantı	tativ	e metho	ods 1n	
		research.	. 1 .1 .1 .	, 1.11 0	. 1	. 1		٠,٠	1.41			
			s to enhance the students							_		
		_	h literature review in dif or preparation of a resea				_	-			Mini	
		research.	or preparation of a resea.	ich prope	JSai	101 a 1	masu	ci ili	.csis ļ	Jojeca	1011111	
			lents competency in plar	ning cor	ndua	ctino	evalı	ıatine	o and	nresen	ting a	
		research projec		mmg, coi	iiduv	cuing,	Cvan	autili	5 ana	presen	uiig u	
CO	1		methodology, evaluate s	significan	ice (	of res	earcl	and	lider	ntifv re	search	
	-	problems.		<i></i>		_ 100				) 10		
CO	2	*	esign, sampling design a	ınd desig	n ex	perim	ent f	or re	searc	h.		
CO	3	_	resentation of data and in								cs.	
CO	4		port, article, reviews etc						•			
CO	5	Explain intellectua	al property right and rela	ted rights	5							
Unit-		Cont	ent	Contac	et	Le	arni	ng O	utco	me	KL	
No.				Hour								
	Resea	rch Methodology- A	An Introduction-			Know	ledg	e on				
			f research, motivation	fundamental co					_			
I			nificance of research,	2		research methodology,					1,2	
_	1	a of good research.	_		including the meaning					1,2		
	1	ems- definition of re	_		and objectives of research			search				
		sity of defining rese										
		•	g and need of research			Able to understand and						
		n, features of a good		apply the fundamental								
		ch designs, Samplir				principles of research design, including the meaning and necessity of						
II	_	ing design, Sample	npling design, different	4							1 2	
11		•	Experimental Design,	4		resear	-			sity of	1,2	
			xperiment, One – way			rescar	CII U	csign				
		VA, Two- Way AN										
		22, 23 Factorial Des										
			data collection, tools		+	A go	ood	knov	vledg	ge on		
	• •		al, ordinal, interval and			_			_	ta and		
	ratio -	- Attitude scale cons	struction and				-	_		ources		
	measu	rement, rating scale	es, semantic differential			and	too	ls	for	data		
III	(SD),	Use of scale in stati	3		collec	tion				1,2		
	Sched	lules for interviews										
	standa	ardization, developn	nent of survey									
		ments and item anal	ysis for the									
	-	onnaire										
IV			research report, Format	3		Able	to	_	anize		1,2	
	of res	earch report, Differe	ent steps of writing			write	a	com	preh	ensive		

	report, lay out of the research report, How to		research report	
	organize thesis/Dissertation, mechanics of			
	writing research report, standard methods of			
	quoting- presenting the result, written and oral			
	reports, Uses of abstract, format of research			
	report, presentation of statistics - tabular and			
	graphic references and uses of references,			
	Bibliography and presentation of bibliography			
	Intellectual property right (IPR), Introduction		Knowledge on	
	and the need for IPR, IPR in India and		importance of Intellectual	
	worldwide, Patents, Trademarks, Copyright &		Property Rights (IPR)	
	Related Rights, Industrial Design, Traditional		both in India and globally	
V	Knowledge and Geographical Indications,	2		1.0
V	Patentable and non-patentable, patenting life,	3		1,2
	Filing of a patent application, The different			
	layers of the international patent system, Case			
	studies on Basmati rice, Turmeric, and Neem			
	patents			
	Laboratory using R Software:		Knowledge on various	
	1. Analysis of One way ANOVA;		statistical experiments	
	2. Analysis of Two way ANOVA;		and simulations using R	
	3. Analysis of CRD			
	4. Analysis of RBD			
D4'1	5. Analysis of 22 and 23 Factorial Experiment	<b>(0</b>		1,2,
Practical	6. Simulation-I using R (Bernoulli, Binomial,	60		3,4
	Poisson and Geometric distribution.).			
	7. Simulation-II using R (Exponential and			
	Normal distribution).			
	8. Simple random Sampling			
	9. Stratified Random Sampling			

#### REFERENCES

- R1: Boyle JS. Styles of ethnography. In: JM Morse, editor. Critical issues in qualitative research methods.. Thousand Oaks, CA: Sage, 1994:159–85.
- R2: Coughlan M., Cronin P. and Ryan F. (2007). Step-by-step guide to critiquing research. Part 1: quantitative research. British journal of Nursing 16 (11).
- R3: Creswell, JW. (1998). Qualitative Inquiry and Research Design Choosing Among Five Traditions. Thousand Oaks, CA: Sage Publications.
- R4: Crotty, M. (1998). The Foundations of social research: Meaning and perspective in the research process. London: Sage.
- R5: Denzin, NK. (1978). Sociological Methods. New York: McGraw-Hill.
- R6: Hanson WE, JW Creswell, VL Plano Clark, KS Petska and JD Creswell. Mixed Methods Research Designs in Counseling Psychology. Journal of Counseling Psychology, 2005, Vol. 52, No. 2, 224–235. http://www.preciousheart.net/chaplaincy/Auditor Manual/13casesd.pdf
- R7: Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixes approaches, 2nd Ed. Boston: Allyn & Bacon.
- R8: Kothari C., R. (2004). Research Methodology: Methods and Techniques. New Delhi. New Age International (P) Limited, Publishers.
- R9: Krueger, A. R. (1994). Focus Groups: A Practical guide for Applied Research, Thousand Oaks, CA: Sage Publications

- R10: L., L. Espinosa and M. Yamashita (2015). EvaluationToolkit. Evaluation Guide. Analyze Data. Retrieved from: http://toolkit.pellinstitute.org/evaluation-guide/analyze/analyze-qualitative-data/
- R11: Neuman, W. L. (2000). Social research methods. Qualitative and Quantitative approaches (4th Ed.). Boston: Allyn and Bacon.
- R12: Patton, MQ. (1999). "Enhancing the quality and credibility of qualitative analysis." HSR: Health Services Research. 34 (5) Part II. pp. 1189-1208.
- R13: Patton, MQ. (2001). Qualitative Evaluation and Research Methods (2nd Edition). Thousand oaks, CA: Sage Publications.
- R14: Strauss, A. & Corbin, J. (1994). "Grounded Theory Methodology." In NK Denzin & YS Lincoln (Eds.) Handbook of Qualitative Research (pp. 217-285). Thousand Oaks, Sage Publications.

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain research methodology, evaluate significance of research and identify research problems.	1, 2, 3						
2	Explain research design, sampling design and design experiment for research.	2,3						
3	Collection and representation of data and interpret the data with descriptive statistics.	2,3						
4	Explain to write report, article, reviews etc.	2, 3, 4						
5	Explain intellectual property right and related rights	1, 8						

		SEMESTER	– II							
Course Title		RSAL HUMAN VALUE	S (UH	V) + P	ROFE	SSION	IAL E	THIC	S	
Course code	e 24MSCE121R	Total credits: 2	L	T	P	S	R	O/I	?	C
		Total hours: 30T	2	0	0	0	0	0		2
Pre-requisit	e Nil	Co-requisite				Nil				
Programme		MASTER OF SC								
Semester		Fall/ I semester of fi				-				
Course	_	udents appreciate the esse		•		•				
Objectives	of all human b	'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings								
	profession as understanding perspective fo based living ir 3. To highlight p	ne development of a Holis s well as towards hap of the Human reality rms the basis of Universa n a natural way blausible implications of s et, trustful and mutually fu	piness and t l Hum uch a l	and he res an Val Holisti	prospost of lues and c unde	erity b Exister d move	pased ace. Su ement to ang in to	on a ach a toward	hods v	orrect olistic value- thical
	interaction wit	th Nature						-		8
CO1		The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of								
CO2		ny dogma or value prescr	iptions							
CO3	It is a process o	f self-investigation and se	lf-expl	oratio	n, and	not of g	giving s	sermoi	ns.	
CO4	facilitated to v subsequent Exp This process of	Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.  This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous								
Unit-	sen-evolution.	Content					Cor	ıtact	1	KL
No.		Content						our		IXL
	urse Introduction -	Need, Basic Guidelines, C	Content	and P	rocess	for	111	, 41		1,2
1. 2. 3. 4. 5. 6.	Value Education Self-Exploration—v Acceptance' and Exexploration Continuous Happin Aspirations Right understandin requirements for fu their correct priorit Understanding Hap of the current scena	opiness and Prosperity cor ario he above human aspiration	proce the me k at ba cal Fac every	ss; 'Na chanis sic Hu cilities humar	atural om for some oman - the band of being ical ap	self- asic with praisal	,	7		

	Understanding Harmony in the Human Being - Harmony in Myself!  1. Understanding human being as a co-existence of the sentient 'I' and the		1,2
	material 'Body'		
	2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha		
	3. Understanding the Body as an instrument of 'I' (I being the doer, seer and		
II	enjoyer)	10	
	4. Understanding the characteristics and activities of 'I' and harmony in 'I'	10	
	5. Understanding the harmony of I with the Body: Sanyam and Swasthya;		
	correct appraisal of Physical needs, meaning of Prosperity in detail		
	6. Programs to ensure Sanyam and Swasthya-Practice Exercises and Case		
	Studies will be taken up in Practice Sessions.		
	Understanding Harmony in the Family and Society-Harmony in Human-		1,2
	Human Relationship		1,2
	1.Understanding Harmony in the family – the basic unit of human		
	interaction		
	2. Understanding values in human-human relationship; meaning of Nyaya		
	and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas)		
	and Program for its fulfillment to ensure Conay-tripu; Frust (Vishwas) and Respect (Samman) as the foundational values of relationship		
	3. Understanding the meaning of Vishwas; Difference between intention		
Ш	and competence	10	
	4. Understanding the Meaning of Samman, Difference between respect and		
	differentiation; the other salient values in relationship		
	5. Understanding the harmony in the society (society being an extension of		
	family):		
	Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals		
	6. Visualizing a universal harmonious order in society- Undivided Society		
	(Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family		
	to world family!-Practice Exercises and Case Studies will be taken up in		
	Practice Sessions.		
	Understanding Harmony in the Nature and Existence - Whole		1,2
	existence as Co-existence		
	1. Understanding the harmony in the Nature		
	2. Interconnectedness and mutual fulfillment among the four orders of nature-		
IV	recyclability and self- regulation in nature	8	
	3. Understanding Existence as Co-existence (Sah-astitva) of mutually		
	interacting units in all-pervasive space		
	4. Holistic perception of harmony at all levels of existence-Practice Exercises		
	and Case Studies will be taken up in Practice Sessions.		1.2
	Implications of the above Holistic Understanding of Harmony on		1,2
	Professional Ethics		
	1. Natural acceptance of human values		
	2. Definitiveness of Ethical Human Conduct		
	3. Basis for Humanistic Education, Humanistic Constitution and Humanistic		
	Universal Order	40	
V	4. Competence in professional ethics:	10	
	a) Ability to utilize the professional competence for augmenting universal		
	human order		
	b)Ability to identify the scope and characteristics of people-friendly and		
	eco- friendly production systems,		
	c) Ability to identify and develop appropriate technologies and management		
	patterns for above production systems.		

- 5.Case studies of typical holistic technologies, management models and production systems
- 6. Strategy for transition from the present state to Universal Human Order:
- a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- b) At the level of society: as mutually enriching institutions and organizations

- T1: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
- T2: The teacher's manual: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics Teachers Manual, Excel books, New Delhi, 2010

T3: A set of DVDs containing

- Video of Teachers' Orientation Program
- PPTs of Lectures and Practice Sessions
- Audio-visual material for use in the practice sessions

#### **REFERENCE BOOKS:**

- R1: B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
- R2: PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
- R3: Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,1991
- R4: Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
- R5: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III,1972, limits to Growth, Club of Rome's Report, Universe Books.
- R6: Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) KrishiTantra Shodh, Amravati.
- R7: A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
- R8: E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
- R9: A.N. Tripathy, 2003, Human Values, New Age International Publishers.

### **OTHER LEARNING RESOURCES:**

Relevant websites, movies and documentaries

- 1. Value Education websites, <a href="http://uhv.ac.in">http://www.uptu.ac.in</a>
- 2. Story of Stuff, http://www.storyofstuff.com
- 3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
- 4. Charlie Chaplin, Modern Times, United Artists, USA
- 5. IIT Delhi, Modern Technology the Untold Story

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
	The methodology of this course is explorational and thus	
1	universally adaptable. It involves a systematic and rational	1, 3
	study of the human being vis-à-vis the rest of existence.	
2	It is free from any dogma or value prescriptions.	1,3
3	It is a process of self-investigation and self-exploration, and not	1,3
3	of giving sermons.	1, 3
	Whatever is found as truth or reality is stated as a proposal and	
4	the students are facilitated to verify it in their own right, based	1,5
4	on their Natural Acceptance and subsequent Experiential	1, 3
	Validation.	
	This process of self-exploration takes the form of a dialogue	
5	between the teacher and the students to begin with, and then to	1 5 0
3	continue within the student leading to continuous self-	1, 5, 8
	evolution.	

			SEMESTE	R – II							
Course			ICATION MASTER					_			
Course	code	24UMPD121R	Total credits: 2	_	L	T	P	S	R	O/F	C
D	• •,	NT*1	Total hours: 60P		0	0	4	0	0	0	2
Pre-re		Nil	Co-requisite MASTER OF S	CIENC	OF I	N 700	)I ()(	Nil			
Progra Semest			Fall/ I semester of								
Course		1. To familiarize st	tudents with the transf	formation	on o	f sente	nces at	nd the	appro	priate u	se of
Object		1. To familiarize students with the transformation of sentences and the appropriate use o prepositions.							01		
			writing skills in differ								ing.
			ning by reinforcing, su	ıbstituti	ing f	or, or o	contrac	licting	verba	1	
CO	<b>\</b> 1	communication.	ns, tag questions, and	lidioma	7.00#	maatly,					
CO		Discuss and analy	ze different sentence	tynes at	nd vo	oices.					
CC			paragraphs, precis, an	• •			ument	s.			
CC			Describe SWOT analysis, goal setting, and personal hygiene principles.								
CC	)5	Illustrate non-verb	al communication and	d body	lang	guage c	oncept	s.			
Unit-		Conte	nt	Conta	act	-	Learn	ing O	utcom	e	KL
No.				Hou	ır						
	Gram					Ident	ify co	mmor	erro	rs and	
		of Prepositions					_			curacy	
I	_	questions		10	)	in co	mmuni	ication	1.		1,2
		ms, Phrases and Cla									
		ple, complex, comp	ound sentences			-	carn when and how to use ch voice effectively to suit e context and tone.  evelop clarity in writing by iminating ambiguity and				
							1,2				
111	J = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 =				to Suit	1,2					
		ng Skills	2011				Develop clarity in writing by			ıg by	
		he Basics of Writing; avoid ambiguity and					_	-			
		agueness					e expre				
III		aragraph Writing				helps to focus on precise and					1,2
		eis Writing				concise communication.					
	• Lette	er Writing									
	• Resi	ume, CV and Cover	Letter								
	Self-N	<b>Management Skills</b>				Learr	to ide	entify	person	al	
	• SW	OT Analysis				streng	gths, w	eakne	sses,		
	• Self	-Regulation- Goal S	Setting			oppoi	rtunitie	es, and	l threa	ts for	
		sonal Hygiene				perso	nal gro	owth a	nd sel	f-	
	Non-	Verbal Communic	ation-Sciences of			impro	oveme	nt.			
		Language				T.14	· C	1 :	4		
		at is Non-Verbal Co	mmunication &				ify and		•		
		y Language,					ent for		-	4	
IV		nents of Communic		15	:	_	iage in ssiona	_		u	1,2
1 4		es of Body Languag		13	,	profe	551011a	ı seiili	igs.		1,2
	_	ortance and Impact									
	• Typ	es of Communication	on through Body								
		guage,									
		oduction to Haptic,	Introduction to								
		esics,									
		oduction to Proxemi									
		y Language Do's ar	nd Don'ts, Doubt								
	Clea	aring Session.									

	Group Discussion (Theory)		Understand the relevance of		l
	• Importance,		group discussions and		
V	• Planning, Elements, and Skills assessed;	10	develop strategies for starting	1.2	
V	• Effectively disagreeing,	10	group discussions confidently	1,2	
	• Initiating,		and effectively.		
	• Summarizing and Attaining the Objective		and checuvery.		

T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

T2: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

#### **REFERENCES:**

R1: Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky, 2019

R2: A Textbook for AECC English Communication: Interface, Dr. Kironmoy Chetia and PranamiBania Breez Mohan Hazarika, January 2019.

## **OTHER LEARNING RESOURCES:**

https://youtu.be/x60GHpQ8gJk https://youtu.be/Ke_oSN-BCaY https://youtu.be/TDPDtrLxT-c

https://www.classcentral.com/report/toefl-preparation/

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Explain prepositions, tag questions, and idioms correctly.	1, 2, 4, 8					
2	Discuss and analyze different sentence types and voices.	1, 2, 4, 8					
3	Explain effective paragraphs, precis, and professional	1, 2, 4, 8					
3	documents.	1, 2, 4, 8					
4	Describe SWOT analysis, goal setting, and personal hygiene	1, 2, 4, 8					
4	principles.	1, 2, 4, 8					
5	Illustrate non-verbal communication and body language	1, 2, 4, 8					
	concepts.	1, 2, 7, 0					

	SEMESTER – III									
<b>Course Tit</b>	tle	ORNAMENTA	L FISH F	ARMIN	G (TP	S-II)				
Course coo	de 24MSZO213R	Total credits: 2	]	L T	P	S	R	O/F	C	
		Total hours: 60P	(	0 0	4	0	0	0	2	
Pre-requis	ite Nil	Co-requisite				Nil				
Programm	ie	MASTER OI								
Semester		Fall/ I semester								
Course		nportance of orname	ental fish f	arming in	relatio	n with	entrep	reneur	ship	
Objectives	_									
	_	nts knowledge about	ornamenta	ıl fish rea	ring to	make	them s	elf-		
	sustainable.									
		iques of constructio		aquarium	and its	maint	enance	<b>e</b> .		
CO1	· ·	al fish and aquariun	-							
CO2		of aquaria and apply			_					
CO3		ng of indigenous or	namental f	ish and es	timate	physic	co chei	nical		
characteristics of aquarium water.										
CO4		Analyse physico-chemical characteristics of aquarium water, design and construct								
		biological filter for culturing plankton.  Analyze ornamental fish farms through field visits.								
CO5										
Unit-No.	Cont	ent	Contact	Le	arning	g Outc	ome		KL	
			Hour							
	Ornamental fishes	_		Student						
	• Identification of co	ommon ornamental		identify common Ornamental						
I	fishes.		15	Fishes and common aquarium				ım	1,2	
	• Identification of co	mmon aquarium		plants						
	plants.									
	Designing and setting			Student		e able	to			
II	Aquarium designing		10	design and					1,2	
	Setting up and man	intenance of fresh		maintain aquaria					,	
	water aquaria.	-								
	Rearing and physic			Student						
	parameters of aqua			Indigen				in		
III	Rearing of indigen	ous ornamental	15	Aquariu					1,2	
	fish in aquarium.			estimat		-			-,-	
	• Estimation of phys			chemica			tics of			
	characteristics of a	-		Aquarit						
	Biological filter and	-		Student			able			
IV	Preparation of biol	~	10	Constru		•		and	1,2	
	removal of ammon	•		develop	plank	ton cul	lture		,	
	Culture of plankton	18.		T. *** *	1 .					
	Field study	1.0	4.0	It will h	_		nts to g	get		
V	Visit to ornamental fish farm.		10	broad k		-			1,2	
				orname	ntal fis	h farm	ıng			

- T1: Ornamental fish farming by B. Andrews. (Latest Edition) Kindle Edition.
- T2: Textbook of aquaculture by B. Ahilan, N. Felix and R. Santhanan (Latest Edition) Daya Publishing House.
- T3: Aquarium Fish: A definite guide to identifying and keeping fresh water and marine species by
- T4: M. Bailey and G. Sandford (Latest Edition)

#### **REFERENCE BOOKS:**

- R1: The freshwater fishes of the Indian region by Jayaram, K.C. 1999. New Delhi: Narendra Publishing House. 551 pp.
- R2: Fishes of northeast India by Vishwanath, W., W.S. Lakra and U.K. Sarkar. 2007. Lucknow: NationalBureau of Fish Genetic Resources. 264 pp.
- R3: A textbook of Fish Biology and Fisheries by S.S. Khanna and H. R. Singh (3rd Edition). Narendra PublishingHouse, Delhi.
- R4: Handbook of the freshwater fishes of India by Beaven C R (Latest Edition) Narendra Publishing House.
- R5: Fish and Fisheries of India by Jhingran V. G. (4th Edition). Hindustan Publishing Corporation
- R6: Ichthyology by Lagler et al. (2nd edition). Wiley Publication.
- R7: Fish and Fisheries by Pandey (Latest Edition). Rastogi Publications.
- R8: Fishes by Chandy, M. (1st Edition). National Book Trust, India.

#### OTHER LEARNING RESOURCES:

1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Identify ornamental fish and aquarium plants.	1
2	Design setting up of aquaria and apply knowledge on	1 0
	farming for its maintenance.	1, 8
3	Demonstrate rearing of indigenous ornamental fish and	1 0
	estimate physico chemical characteristics of aquarium water.	1, 8
4	Analyse physico-chemical characteristics of aquarium water,	
	design and construct biological filter for culturing	1, 8
	plankton.	
5	Analyze ornamental fish farms through field visits.	1, 7

			SEMESTER –	Ш								
Course	Title		RESEAR	СН	ETHICS	S						
Course	code	<b>24UMRE214R</b>	Total credits: 1	L	T	P	S	R	O/F	С		
			Total hours: 15	1	0	0	0	0	0	1		
Pre-rec	quisite	Nil	Co-requisite				Nil			•		
Progra	mme		MASTER OF SCII	ENC	CE IN ZO	OOLO	GY					
Semest	er	Fall/ I semester of first year of the programme										
Course	;	This course aims	s to lay a foundation for er	npir	rical resea	arch an	ıd mak	e stud	ents a	ware of		
Objecti	ives	relevant guidelin	elevant guidelines, policies, and codes relating to ethical research, as well as to									
		provide, via a stu	dy of ethical theories, conc	epts	S.							
CC	<b>)</b> 1	Describe and ap	ply research ethics theories	and	and methods.							
CO	)2	Explain research	n ethics issues such as respo	nsil	bility, vet	tting, a	nd mis	condu	ct.			
CO	)3	Illustrate argume	ents and results in ethical re	esea	rch inqui	ries.						
CO	)4	Identify and app	ly procedures for sampling	, da	ta collect	ion, an	d repo	rting.				
CO	)5	Apply ethical pr	rinciples to research design	and	evaluation	on						
Unit-		Co	ontent	(	Contact	et   Learning Outcome				KL		
No.					Hour							
			to the course and each				rstand					
			moral theory. Ethics:				key e		,			
		_	ophy, nature of moral			1 ~	_	nd mo				
т	-		ons. Research regulation;		2			esearc		1.2		
I		-	ch ethics. Honesty, candor,		3			itically	<i>'</i>	1,2		
	_	_	ty. Data ownership and				ate iss					
		-	f interest; collaboration.					search	l			
			n subjects. Research and			ethics	S.					
		chers in society.	ICT Ethios with manner to	+		I I a d a	rstand	1				
			JCT- Ethics with respect to Intellectual honesty and	'			ethica					
			ntific misconducts:					น elated 1	to			
			on, and Plagiarism (FFP).				•	onduct,				
			: duplicate and overlapping	,			nstrate		'			
II		-	cing. Selective reporting and		2			honest	v	1,2		
"	_	presentation of da		4	2		esearcl		.,	1,2		
	morep	resemble of the						cogniz	e			
						_	revent	_	.			
						scien						
							onduct					
	PUBL	ICATION ETH	ICS- Publication ethics:	$\top$		Unde	rstand	the				
	definit	ion, introduction	and importance. Best			impo	rtance	of				
	practic	es / standards set	ting initiatives and			publi	cation	ethics,	,			
	guideli	ines: COPE, WAI	ME, etc. Conflicts of			recog	nize b	est				
	interes	t. Publication mis	sconduct: definition,			pract	ices an	d				
III	concep	ot, problems that l	ead to unethical behaviour		3	stand	dards 1,2					
	and vio	ce versa, types. V	iolation of publication									
		authorship and co	•									
		_	ation misconduct,									
			Predatory publishers and									
	journa	ls.										

	OPEN ACCESS PUBLISHING-Open access		Understand the	
	publications and initiatives. SHERPA/RoME0		concept and	
	online resource to check publisher copyright & self-		significance of open	
IV	archiving policies. Software tool to identify	3	access publishing	1,2
	predatory publications developed by SPPU. Journal			
	finder / journal suggestion tools viz. JANE, Elsevier			
	Journal Finder, Springer Journal Suggester, etc.			
	PUBLICATION MISCONDUCT Group		Gain proficiency in	
	Discussions; Subject specific ethical issues, FFP,		navigating indexing	
	authorship. Conflicts of interest. Complaints and		and citation	
	appeals: examples and fraud from India and abroad.		databases	
	Software tools; Use of plagiarism software like			
	Turnitin, Urkund and other open-source software			
$\mathbf{V}$	tools.	4		1,2
	DATABASES AND RESEARCH METRICS-			
	Databases: Indexing databases. Citation databases:			
	Web of Science, Scopus, etc. Research Metrics:			
	Impact Factor of journal as per Journal Citation			
	Report, SNIP, SJR, IPP, Cite Score. Metrics: h-			
	index, g index, I 10 index, altmetrics.			

- T1: Bird, A(2006). Philosophy of Science. Routledge.
- T2: MacIntyre, Alasdair (1967) A Short History of Ethics. London.
- T3: Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019)

#### **REFERENCE BOOKS:**

- R1: National Academy of Science, National Academy of Engineering and Institute of Medicine (2009).

  On Being a Scientist: A Guide of Responsible Conduct in Research: Third Edition, National academics Press
- R2: George R, (2011). Sociological Theory, Rawat Publication, New Delhi, India. George R, (2019). Post Modern Social Theory, Rawat Publication, New Delhi, India.

### OTHER LEARNING RESOURCES:

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe and apply research ethics theories and methods.	1, 3, 5						
2	Explain research ethics issues such as responsibility, vetting, and misconduct.	1, 3, 5						
3	Illustrate arguments and results in ethical research inquiries.	1, 3, 5						
4	Identify and apply procedures for sampling, data collection, and reporting.	1, 3, 5						
5	Apply ethical principles to research design and evaluation	1, 3, 5						

	SEMESTER – III											
Course Ti			,	ommun	icativ	e Engl	ish &	Soft S	<del>,                                    </del>			
Course co	de 24UMPD211R	Total credi		L	T	P	S	R	O/F	C		
		Total hours		0	0	4	0	0	0	2		
Pre-requis	1		equisite				Nil					
Programn			CR OF SCIE									
Semester			ester of first	•	_	_						
Course		1. To acquaint students with the various tools of an effective presentation.										
Objectives		2. To acquire the speaking skill, instruct, influence, engage, educate, or appease the listeners.										
			. 1 '1'.	1 12	C		1	. 1	٠,	C		
	3. To increase profi		•			ume a	na pro	viae gi	uidanc	e Ior		
CO1	self- promotion a  It will prepare the le					dohori	emo in	front	of oth	ara .		
CO2	It will have a positive									C1S.		
CO2	It will arm the stude			_						nal		
	resume.	mo will all	me mecessary	, wors ar	ia skii	15015 11	prepa	ne pro	1000101			
CO4	They will learn to h	ighlight and	assess them	selves ir	socia	l medi	a.					
CO5								w, dev	velop			
	strategies to crack i	_		_					_	dence		
Unit-	Content		Contact				utcon			KL		
No.			Hour									
	Presentation Skills			Unders	tand tl	he imp	ortanc	e of				
	• Introduction			present	ation	skills i	n perso	onal ar	nd			
	• Essential characteristics of a good presentation			profess					ps			
I			4	to reco	_	-				1,2		
	•	Preparation of a good presentation		make a	_				ıch			
	presentation			as clari		gagem	ent, an	d				
	D 112 CLUI			structui		1 .	1 1		1			
	Public Skills			Learn p	-	_	_		al			
	<ul><li>Fear of Public Speaking</li><li>Understanding and Ove</li></ul>	-		strategi speakir		_	e and r	eauce				
	Fear of Public Speaking	_		speakii	ig alix	icty.						
	<ul> <li>Confidence and Contro</li> </ul>	_										
	<ul> <li>Physiology and Stress</li> </ul>	*										
	Control/Process,											
	• Tips for Presentations a	and Public										
II	Speaking,		20							1,2		
	• Tips for Using Visual A	Aids in										
	Presentations,											
	• Process for Preparing a											
	Creating Presentations,											
	• Delivering Presentation	ns										
	Successfully,											
	Doubt Clearing and Su  Main Paints	mmary of										
	Main Points											

	Practical session on Resume,		Gain expertise in drafting impactful	
	Curriculum Vitae, Writing cover		cover letters and learn to create	
	letter & LinkedIn Profile		tailored resumes that highlight	
	• Preparation, submission &		relevant skills and achievements.	
III	screening of Resume.	10		1,2
	• Practical session on cover letter			
	screening session			
	Creating a profile on LinkedIn			
	How to utilize it			
	Leadership & Management Skills		Understand the fundamental	
	• Concepts of Leadership,		principles and importance of	
	• Leadership Styles,		leadership in various contexts.	
	Manager VS Leader,			
	• How to be an Effective Leader,			
IV	Mock/ Practice Session,	20		1,2
	• Doubt Clearing Session.			
	Research Paper – Writing Skills			
	• How to write a research paper			
	Key point in Research Work			
	Mock Interview		Identify critical aspects of	
	Practical Mock Interview,		conducting research, including	
	• Feedback- Receiving Feedback,		hypothesis formation and data	
$\mathbf{v}$	• Giving Feedback,	6	analysis	1,2
	<ul> <li>Advantages of effective Feedback,</li> </ul>	Ŭ	,	-,-
	How to deal with negative			
	feedback.			

T1: Barrett, Grant. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.

T2: McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

### **REFERENCE BOOKS:**

R1: Garg. Manoj Kr. (2018) English Communication: Theory and Practice

# OTHER LEARNING RESOURCES:

https://brightlinkprep.com/10-best-toefl-prep-books/https://files.eric.ed.gov/fulltext/EJ1132742.pdf

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	It will prepare the learners to speak with greater control and charisma in front of others.	1, 4, 8				
2	It will have a positive impact in their thought process and problem-solving skills.	1, 4, 8				
3	It will arm the students with all the necessary tools and skillsets to prepare professional resume.	1, 4, 8				
4	They will learn to highlight and assess themselves in social media.	1, 4, 8				
5	It will impart in them techniques to solve critical problems in an interview, develop strategies to crack interviews, improve their communication skills, boost their confidence	1, 4, 8				

SEMESTER – III											
Course T	itle		ANIMA	AL PHY	YS	IOL	OGY				
Course code		24MSZO216R	Total credits: 4	]	L	T	P	S	R	O/F	С
			Total hours: 45T+3	30P	3	0	2	0	0	0	4
Pre-requ	isite	Nil	Co-requisite						Nil		
Program	me	MASTER OF SCIENCE IN ZOOLOGY									
Semester	1		Fall/ I semester of first year of the programme								
Course		1) To provide knowledge of animal body system to reveal physiological homologies,									
Objectives		pattern of physiological adaptation to various environments.									
		2) To introduce various principles that underlies higher level integrative bodily									
		functions.									
		3) To provide a comprehensive knowledge of functional physiological pathways common to all animals ranging from molecular, biochemical, cellular processes.									
COL										_	
CO	L		ncepts of gas excha-	nge in	IU1	ngs a	and di	iffere	nt typ	es of re	spiratory
CO2			ans and animals.	mn cnd	00:	nnaci	tina ti	101122			
CO2			ction of heart as a pur	•			_			in1	aton di
COS			Describe human response to different stimulus and ability of brain in understanding, storing information and controlling body.								
CO4		_	•	•	vn.	of	compl	lov f	oods	accimila	tion and
04	'	Illustrate the mechanism of breaking down of complex foods, assimilation and elimination of the nitrogenous wastes									
CO5		Discuss sensory organs (ear and eye) and the perception prepared by the brain.									
Unit-		Cont		Conta	_			_	g Out		KL
No.		Cont	CIII	Hou		١	Lea	11 111113	g Out	Come	KL
1100	Resp	iratory physiolog	v	1100		T	o und	erstar	d the	concepts	
	_	spiratory pigment	,,			- 1	of gas exchange in the lungs				
		hemocyanin, erythrocruorin-					nd diff		-	_	
	chl	hlorocruorin and haemerythrin					espirat	ory p	igmen	ts in	
	• Pul	lmonary circulation	on: Gaseous			h	umans	and	anima	ls.	
	exc	change through me									
	tiss	sues: Fick's Law,									
I		piratory membran	7							1,2	
	•	fusion									
		ygen and carbon									
		ygen dissociation									
	eff										
		emical and neura piration (briefly)									
		viation, space and deep-sea diving hysiology									
		liovascular physi	ology			T	o und	erstar	d the		
		omposition of blood, Hemostasis,					function of heart as a				
II		Haemopoiesis, Lymphatic system and Lymph Circulation of blood in different animals (briefly), Origin and conduction of the				р	pump and the blood and				
				10			mph a				1,2
	•Circ					ti	ssues	to car	ry gas	es and	
							utrient				
	card	liac impulse				fi	rom th	e tiss	ues an	d heart.	

III	<ul> <li>Nerve and muscle physiology</li> <li>Sensory parts: Sensory receptors, Motor Parts: Effectors</li> <li>Processing of information, Storage of information Synaptic transmission,</li> </ul>	10	To understand and analyze the ways in which we perceive the world around us and our response to stimuli along with the knowledge of	1,2
	neurotransmitters		how the brain stores and understands the information gathered to control our entire body.	
IV	<ul> <li>Gastrointestinal and Renal physiology</li> <li>Digestion, absorption and assimilation; Energy balance and BMR: Definitions;</li> <li>Patterns of nitrogenous excretion in different animals; Counter- current exchanger in the kidney;</li> <li>Regulation of urine formation; Acid base balance (blood and kidney); Homeostasis</li> </ul>	8	To understand the breaking down of complex foods into nutrients that are necessary for our body, assimilation and elimination of the nitrogenous wastes produced as a result of breakdown and utilization in the body.	1,2
V	<ul> <li>Special Senses</li> <li>Vision: The retina structure and photochemistry of vision and function of the visual cortex</li> <li>Hearing: The organ of Corti: structure and function, auditory nervous pathways and function of the cerebral cortex in hearing, Bioluminescence</li> </ul>	10	To understand that the eye and ear function as sensory organs and the visual and audio perception is done by the brain	1,2
Practical	<ul> <li>Estimation of free amino acid using ninhydrin reagent.</li> <li>Blood glucose test.</li> <li>Measurement of lung volume by spirometry.</li> <li>Erythrocyte Sedimentation Rate (ESR).</li> <li>Dissection to show the striated muscle structure of an invertebrate and vertebrate.</li> <li>Dissection of a sample of goat spinal cord to demonstrate the structure of neurons.</li> </ul>	30		1,2,3,4

- T1: Essentials of Animal Physiology by S. C. Rastogi (Latest Edition) Publisher New Age Internationals.
- T2: Textbook of Medical Physiology by Guyton and Hall (Latest Edition). Elsevier.
- T3: Animal Physiology Edn.5 Part II, Verma (P.S) Etc, Aul. H Ed.Nch (James) Himalaya, 2000.
- T4: Chordate Zoology and Animal Physiology, Jordan(El); Verma(P.S), S Chand and Company, 1993.
- T5: Introduction to Animal Physiology, Kay(Ian), Bios Scientific Publishers, 1998.

## **REFERENCE BOOKS:**

R1: Eckert Animal Physiology: Mechanisms and Adaptations by Eckert and Randal (4th Edition).

- W. H. Freeman.
- R2: Animal Physiology by Hill, Wyse and Anderson (3rd Edition). Sinauer Associates,
- R3: Inc. Publishers Sunderland, Massachusetts
- R4: Essentials of Medical Physiology by K. Sembulingam and Prema Sembulingam (7th Edition). Jaypee Brothers Medical Pub
- R5: Physiology by Linda S. Costanzo (7th Edition.). Wolters Kluwer
- R6: Animal physiology: mechanism and adaptations by Eckert R. and Randal D (2nd Edition) CBS publishers and Distributor, New Delhi
- R7: General and Comparative physiology by Hoar W. S.(Latest Edition). Prentice Hall of
- R8: India Pvt. Ltd.
- R9: Animal physiology: Adaptation and Environment by Schmidt-Neilsen (Latest Edition), Cambridge Press.
- R10: Comparative animal Physiology by Prosser C. L. (Latest Edition) Saunders, Philadelphia, USA

#### **OTHER LEARNING RESOURCES:**

- 1. Animal Physiology: <a href="https://swayam.gov.in/nd1">https://swayam.gov.in/nd1</a> noc20 bt42/preview
- 2. Physiology and Biochemistry: <a href="https://swayam.gov.in/nd2">https://swayam.gov.in/nd2</a> cec20 bt19/preview
- 3. Animal Physiology: <a href="https://www.classcentral.com/course/swayam-animal-physiology-12894">https://www.classcentral.com/course/swayam-animal-physiology-12894</a>
- 4. Respiration in the Human Body: <a href="https://www.classcentral.com/course/edx-respiration-in-thehuman-body-3050">https://www.classcentral.com/course/edx-respiration-in-thehuman-body-3050</a>
- 5. Introduction to Brain & Behaviour : <a href="https://swayam.gov.in/nd1_noc20_hs33/preview">https://swayam.gov.in/nd1_noc20_hs33/preview</a>
- 6. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 7. https://www.ncbi.nlm.nih.gov/books/NBK459327/
- 8. <a href="https://hearinghealthfoundation.org/how-hearing-works">https://hearinghealthfoundation.org/how-hearing-works</a>
- 9. https://www.ncbi.nlm.nih.gov/books/NBK50780

CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome			
1	Explain the concepts of gas exchange in lungs and different types	1.2			
1	of respiratory pigments in humans and animals.	1, 3			
2	Describe the function of heart as a pump and connecting tissues.	1, 3			
3	Describe human response to different stimulus and ability of	1.2			
	brain in understanding, storing information and controlling body.	1, 3			
4	Illustrate the mechanism of breaking down of complex foods,	1.2			
4	assimilation and elimination of the nitrogenous wastes	1, 3			
5	Discuss sensory organs (ear and eye) and the perception prepared	1 2			
	by the brain.	1, 3			

		SEMEST	TER – I	II						
<b>Course Tit</b>	le	DEVELO	PMEN	NTA	L BIOL	OGY				
Course cod	de 24MSZO217R	Total credits: 4		L	T	P	S	R	O/F	С
		Total hours: 45T	+30P	3	0	2	0	0	0	4
Pre-requis	ite Nil	Co-requisite	e			•	Nil			•
Programm	ie	MASTER O	F SCIE	NCI	E IN ZO	OLOC	ξY			
Semester		Fall/ I semester of first year of the programme								
Course	1. To provide to	he knowledge of p	re and p	ost	embryon	ic deve	lopme	nt in or	ganisı	m.
Objectives	2. To impart the	knowledge of organ	nogenes	is in	organisi	n.				
	3. To impart kno	wledge on metamor	phosis	and r	regenerat	ion.				
CO1		xplain the basic terminology of animal development, pre and post fertilization events								events
	and morphogenes					-	-			
CO2	Describe the gen	e regulations in axi	s and pa	atter	n format	ion in	drosop	hila, an	nphib	ia and
	chick.									
CO3		ess of organ formation								
CO4		anism for regenerat								
CO5	Describe metamo	orphosis and types o	f cell de	eath.						
Unit-No.	Cont	ent	Conta	ict	Le	arning	Outco	ome		KL
				r						
	Modern concepts of	development			Student	ain				
	• Potency				the key	_				
	• Commitment				development, including potency, commitment, cell fate					
	<ul> <li>Specification</li> </ul>	•			_					
	• Induction				etc. with			_		
	Competence	_			how the	_			ıte	
	Determination				to organ	iismai (	aeveloj	oment.		
	• Differentiation									
	• Cell fate and cell l	ineages								
	• Stem cells									
	Genomic equivaler	nce								
	<ul> <li>cytoplasmic determ</li> </ul>	ninants								
	<ul> <li>Imprinting</li> </ul>									
I	• Mutant		7							1,2
	• Transgenics in ana	alysis of								
	development.									
	Fertilization									
	<ul> <li>Pre and post fertiliz</li> </ul>	zation events,								
	• Activation of eggs									
	<ul> <li>Gamete fusion</li> </ul>	Gamete fusion								
	• Prevention of phylo	ogeny.								
	Morphogenesis and	cell adhesion								
	• The thermodynam	nic model of cell								
	interaction									
	• Concept of morp	hogen gradients								
	and morphogenetic									
	Cell adhesion mole	cules.								
1	<u> </u>		<u> </u>	1						

	Morphogenesis in organism		Students will be able to		
	• Cell aggregation and differentiation in		describe the processes of		
	Dictyostelium,		morphogenesis.		
	• Axis and pattern formation in				
II	Drosophila: Maternal effect genes,	10		1,2	
11	gap genes, pair rule genes, segment	10		1,2	
	polarity genes, homeotic genes and				
	hox genes in development.				
	• Axis and pattern formation in				
	amphibian and chick.				
	Organogenesis in animals		Students will be able to		
	• Vulva formation in <i>Caenorhabditis</i>		explain the processes of		
111		10	organogenesis in animals.	1.2	
III	elegans	10	organogenesis in animais.	1,2	
	Eye lens induction				
	Limb development				
	Regeneration		Students will be able to		
	Epimorphic regeneration of		compare different types of		
137	Salamander limbs	8	regeneration, including	1.2	
IV	Morphallactic regeneration in hydra	ð	epimorphic and morphallactic	1,2	
	Compensatory regeneration in		regeneration.		
	Mammalian liver		_		
	Post embryonic development		Students will be able to		
	• Larva formation		describe post-embryonic		
	Metamorphosis		development processes.		
	_		de velopment processes.		
**7	Chromosomal sex determination in	4.0		1.0	
V	mammals	10		1,2	
	Programmed cell death				
	Apoptosis				
	Autophagy				
	Necrosis				
	• Study of whole mounts and sections				
	of developmental stages of frog				
	through permanent slides: Cleavage				
	stages, blastula, gastrula, neurula, tail-				
	bud stage, tadpole.				
	• Study of whole mounts of				
	developmental stages of chick through permanent slides/model/charts.				
	<ul> <li>Preparation of whole mount of chick</li> </ul>				
	embryo of 13-18, 24-33, 36-48 and				
Practical	48-72 hours and identification of the	30		1,2,3,4	
	developmental stages.			7 7-7	
	• Study of different types of invertebrate				
	and vertebrate eggs from permanent				
	slides/model/charts.				
	• Study of developmental stages of fish				
	from egg to hatching.				
	• Study of regeneration in the tail of				
	tadpoles.				
	• Study of life cycle of <i>Drosophila</i>				
	melanogaster.				

T1: Developmental Biology by Scott F, Gilbert (8th Ed.) NCBI Book self.

# **REFERENCE BOOKS:**

- R1: Human Embryology and Developmental Biology by Bruce, M. Carlson (6th Edition). Elsevier.
- R2: Principles of Development by Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias (5th Edition). Oxford University Press.
- R3: Developmental Biology by Michael J F Barresi and Scott F, Gilbert (12th Edition). Oxford University Press.
- R4: Vertebrates Comparative Anatomy, Function and Evolution by Kardong, K.V. (IV Edition). McGraw-Hill Higher Education.
- R5: Comparative Anatomy of the Vertebrates by Kent, G.C. and Carr R.K. (IX Edition). The McGraw-Hill Companies.
- R6: Analysis of Vertebrate Structure by Hilderbrand, M and Gaslow G.E.(6th Edition). John Wiley and Sons.
- R7: Biology of Vertebrates by Walter, H.E. and Sayles, L.P. (Latest Edition) Khosla Publishing House.
- R8: Developmental Biology by Carol A. Erickson, Leon W. Browder, William R. Jeffery. (3rd Edition), Saunders College Publishing, Philadelphia.
- R9: Principles of Development 5e Hardcover by Lewis Wolpert (5th Edition), Oxford University Press.

# OTHER LEARNING RESOURCES:

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Explain the basic terminology of animal development, pre and post fertilization events and morphogenesis.	1, 3							
2	Describe the gene regulations in axis and pattern formation in drosophila, amphibia and chick.	1, 3							
3	Explain the process of organ formation (organogenesis).	1, 3							
4	Explain the mechanism for regeneration of organs.	1, 3							
5	Describe metamorphosis and types of cell death.	1,3							

Course Title					[	SEMESTER – III	<del>_</del>							
Total hours: 45T+30P   3   0   2   0   0   0   0				RE	LTURE	AQUACU		itle	Course Ti					
Pre-requisite   Nil   Co-requisite   Nil   Programme   MASTER OF SCIENCE IN ZOOLOGY	C	O/F	S R	P	T	Total credits: 4	24MSZO218R	ode	Course co					
Programme   Fall/ I semester of first year of the programme	4	0	0 0	2	0									
Semester   Fall/ I semester of first year of the programme		<u>l</u>					Nil	isite	Pre-requis					
1. This course is designed to provide in depth knowledge of different aquatic eco and different types of fish cultures. 2. To develop theoretical knowledge on pre and post stocking management. 3. To impart knowledge on different aquaculture and fish identification.    CO1														
objectives  and different types of fish cultures.  2. To develop theoretical knowledge on pre and post stocking management.  3. To impart knowledge on different aquaculture and fish identification.  CO1 Explain concepts of different aquatic ecosystems.  CO2 Describe types of aquaculture methods.  CO3 Assess sites and identify species for aquaculture.  CO4 Analyze pre stocking procedure and management.  CO5 Analyze post stocking procedure and management.  Unit-No.  Content  Contact Hour  Aquatic Ecosystems:  Freshwater ecosystems - Lotic and Lentic ecosystems;  Marine ecosystems - oceans and seas, zonation of the seas - rocky, sandy and muddy shores; classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods:  Scope and definition; origins and growth of aquaculture; biological and technological basis; Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage - fed fish culture.  Selection of Sites and species for aquaculture:  Selection of Sites and species for aquaculture:  Selection of Sites and species for aquaculture:  Survey and location of suitable site — topography; soil characteristics; water source; hydrometerological data.  Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  10														
2. To develop theoretical knowledge on pre and post stocking management. 3. To impart knowledge on different aquaculture and fish identification.  CO1 Explain concepts of different aquacit ecosystems.  CO2 Describe types of aquaculture methods.  CO3 Assess sites and identify species for aquaculture.  CO4 Analyze pre stocking procedure and management.  CO5 Analyze post stocking procedure and management.  CO6 Analyze post stocking procedure and management.  CO7 Content Contact Hour  Aquatic Ecosystems:  Freshwater ecosystems - Lotic and Lentic ecosystems;  Freshwater ecosystems - oceans and seas, zonation of the seas - rocky, sandy and muddy shores; classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods:  Scope and definition; origins and growth of aquaculture; biological and technological basis;  Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  2. To different aquaculture and fifferent aquatic systems  Students will learn different types of aquaculture methods  10 It will help the students for site selection and selection of species for aquaculture species; economic and market considerations; seed resources, collection	ystems	aquatic ecosy	of different a	edge (	knowledg									
3. To impart knowledge on different aquaculture and fish identification.  CO1		*1							Objectives					
CO1   Explain concepts of different aquatic ecosystems.														
CO2 Describe types of aquaculture methods. CO3 Assess sites and identify species for aquaculture. CO4 Analyze pre stocking procedure and management. CO5 Analyze post stocking procedure and management.  Unit-No. Content Contact Hour  Aquatic Ecosystems:  Freshwater ecosystems - Lotic and Lentic ecosystems;  Marine ecosystems - oceans and seas, zonation of the seas - rocky, sandy and muddy shores; classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods: Scope and definition; origins and growth of aquaculture; biological and technological basis; Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, monosex culture; cage culture, pen culture, raft culture, sewage - fed fish culture.  Selection of Sites and species for aquaculture:  Selection of Sites and species for aquaculture:  Selection of Sites and species for aquaculture:  Survey and location of suitable site - topography; soil characteristics; water source; hydrometerological data.  Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  Total time thods  Students will learn different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture species; economic and market considerations; seed resources, collection	<u> </u>								CO1					
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CO4   Analyze pre stocking procedure and management.														
CO5   Analyze post stocking procedure and management.    Unit-No.   Content   Contact Hour														
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• Freshwater ecosystems - Lotic and Lentic ecosystems;  • Marine ecosystems - oceans and seas, zonation of the seas - rocky, sandy and muddy shores; classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods: • Scope and definition; origins and growth of aquaculture; biological and technological basis; • Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture: • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data. • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  different aquatic systems  Students will learn different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture	KL	g Outcome	Learning			Content	•		Unit-No.					
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classification of marine habitat - pelagic, benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods:  Scope and definition; origins and growth of aquaculture; biological and technological basis;  Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  Students will learn different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture	1,2			'	7		•		I					
Benthic, neritic, oceanic, littoral and abyssal.  Aquaculture systems and methods: Scope and definition; origins and growth of aquaculture; biological and technological basis; Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture: Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data. Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  Students will learn different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture														
Aquaculture systems and methods:  • Scope and definition; origins and growth of aquaculture; biological and technological basis;  • Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  Students will learn different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture														
• Scope and definition; origins and growth of aquaculture; biological and technological basis; • Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture: • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data. • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  different types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture						<u> </u>								
aquaculture; biological and technological basis;  Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  Types of aquaculture methods  It will help the students for site selection and selection of species for aquaculture		will learn				- ·								
Traditional, extensive, semi - intensive and intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  methods  It will help the students for site selection and selection of species for aquaculture														
intensive culture; monoculture, polyculture, composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection		quaculture				•								
composite culture, mixed culture, mono sex culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  It will help the students for site selection and selection of species for aquaculture	1,2		methods	)	10				II					
culture; cage culture, pen culture, raft culture, sewage – fed fish culture.  Selection of Sites and species for aquaculture:  • Survey and location of suitable site – topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  It will help the students for site selection and selection of species for aquaculture														
Selection of Sites and species for aquaculture:  • Survey and location of suitable site — topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  It will help the students for site selection and selection of species for aquaculture						•								
Selection of Sites and species for aquaculture:  • Survey and location of suitable site — topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  It will help the students for site selection and selection of species for aquaculture						•	-							
• Survey and location of suitable site — topography; soil characteristics; water source; hydrometerological data. • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  students for site selection and selection of species for aquaculture		n the	It will halp					_						
topography; soil characteristics; water source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection						•								
source; hydrometerological data.  • Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection  selection of species for aquaculture							<u> </u>							
• Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection														
species; economic and market considerations; seed resources, collection	1,2	•		)	10	_	-		III					
considerations; seed resources, collection		**************************************	101 aquavar			_								
						-								
and transportation														
Duo Stading Managament		n the	T4 xx 211 12 - 1			<ul> <li>and transportation</li> <li>Pre-Stocking Management:</li> <li>Sun drying, ploughing / tilling, desilting, liming and fertilization, eradication of weed fishes.</li> </ul>								
		_	_											
liming and fertilization, eradication of weed about prestocking	1,2		about presto		8				IV					
• Stocking: Acclimatization of seed and release; species combinations; stocking density; ratio.							-							

V	Post Stocking Management:     Water and soil quality parameters required for optimum production, control of aquatic weeds and aquatic insects, algal blooms;     Specific food consumption, food conversion ratio (FCR), protein efficiency ratio, true net protein utilization, apparent net protein utilization, biological value of protein.	10	It will help the students to get the knowledge Regarding different post stocking management	1,2
Practical	<ul> <li>Determination of water temperature, pH, salinity, turbidity.</li> <li>Analysis of total alkalinity of water.</li> <li>Determination of total hardness of water.</li> <li>Estimation of dissolved oxygen, BOD of water.</li> <li>Estimation of phosphates and CO2.</li> <li>Dissection of pituitary gland of fish.</li> <li>Estimation of primary productivity using dark and light bottle.</li> </ul>	30		1,2,3,4

- T1: Jhingran V.G. 1991. Fish and Fisheries of India. Hindustan Publ Corporation India, Pillay TVR. 1990
- T2: Blackwell rath RK. 2000 freshwater aquaculture. Scientific publ.
- T3: Landau M. 1992. Introduction to Aquaculture. John Wiley & Sons.
- T4: A textbook of Fish Biology and Fisheries. S.S. Khanna and H. R. Singh. (3rd Edition) Narendra Publishing House, Delhi

# **REFERENCE BOOKS:**

- R1: Huet J. 1986. A text Book of Fish Culture. Fishing News Books Ltd.
- R2: Mathew Landau. 1995. Introduction to Aquaculture. Daya Publishing House, New Delhi
- R3: Jhingran, V. G. 1982. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
- R4: Chakrabarti, N. M. 1998. Biology, Culture and Production of Indian Major Carps. Narendra Publishing House, New Delhi.
- R5: General and Applied Ichthyology by Gupta S.K., Gupta P.C. (Latest Edition). S Chand and Company
- R6: Handbook of the freshwater fishes of India by Beaven C R. (Latest Edition). Narendra Publishing House.

# **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Explain concepts of different aquatic ecosystems.	1,3
2	Describe types of aquaculture methods.	1,3
3	Assess sites and identify species for aquaculture.	1,3
4	Analyze pre stocking procedure and management.	1, 3, 8
5	Analyze post stocking procedure and management.	1, 3, 8

		SEMESTER	R – III								
<b>Course Title</b>		ANIMA	L DIV	ERS	ITY						
Course code	24MSZO219R To	otal credits: 4		L	T	P	S	R	O/F	C	
	To	otal hours: 45T-	+30P	3	0	2	0	0	0	4	
<b>Pre-requisite</b>	Nil	Co-requisite	;			•	N	il	•		
Programme		MASTER OF SO	CIENC	E IN	ZOO	LOG	Y				
Semester	Fal	l/ I semester of f	first ye	ar of	the pi	rogra	mme				
Course	1.To impart the knowled	lge on concept of	biolog	ical d	iversi	ty and	its ir	nport	ance.		
Objectives	2. To provide the inform	-	_					_			
	conservation approach		•				·				
	3. To provide knowledge	on adaptation in	anima	ls and	l their	conse	ervati	on sti	rategy.		
CO1	Describe animal kingdon										
CO2	Explain animal diversity	in Indian contex	t.								
CO3	Describe salient features	and composition	n of life	form	ıs.						
CO4	Analyse adaptations in a										
CO5	Describe the conservation	<u> </u>	oted in	India	for co	nserv	ation	of w	ildlife.		
Unit-No.	Content		Cont			earni				KL	
	Conten	,	Hou				<b>s</b> 0			-111	
	Introduction to animal	diversity:			Stud	ents v	vill ur	nderst	tand		
	Biodiversity: Concept of biological					nport					
	diversity;				dive	_			<i>B</i>		
	Global biodiversity l	notsnots:				J					
I	RAMSAR convention		7							1,2	
	RAMSAR sites.	ii uii u									
	Outline of Animal K	ingdom									
	Classification with e	-									
	Animal diversity in Inc	-			Stud	ents v	vill be	able	to		
	General profile of far			know overall fa			10				
	resources, endemic and threatened species.  • Protected areas: Biosphere			10		profile of India, concept of protected areas.					
II										1,2	
										- <b>,-</b>	
	reserve, national par	_									
	sanctuaries	as and									
	Salient features and co	mnosition of			Stu	dents	will k	now			
	life forms:	inposition of							atures		
	• Salient features and co	omnosition of			_	com					
	life forms in terrestria	^			for	•		J.1 01			
III	cavernicolous ecosyst	<i>′</i>	10	)		• •				1,2	
	• Salient features and										
	life forms in freshy	-									
	and marine ecosystem	·									
	Adaptations in animal				Stu	dents	will l	nave l	pasic		
	_	-				a on a					
	• Terrestrial, desert and aquatic adaptation					abilit	_		nal		
IV	<ul><li>Animal diversity and human health:</li></ul>				_	ersity				1,2	
_ •	Important pathogenic	8			- 7				1,2		
		thogenic life forms sity and human society:									
	Ethnozoology and Zo	- 1									
	Conservation and ma				Stud	ents v	vill he	ave			
$\mathbf{V}$	wildlife:	magement or	10	)		erstan				1,2	
	wiiuiiit.				unue	ısıall	anng (	/11			

	• Principles of conservation,		different conservation	
	biodiversity management		programme adopted in	
	approaches		India for the conservation	
	• Human wildlife conflict; Peoples		of animal diversity.	
	participation in managing			
	protected areas			
	Wildlife health and disease			
	Wildlife trade and laws: Wildlife			
	Protection Act, 1972			
	• Red Data Book; Measure to			
	control poaching and wildlife			
	trade			
	• Study of invertebrate museum			
	specimen (two specimen from each			
	phylum).			
	Study of invertebrate museum			
	specimen (two specimen from each			
	phylum).			
Practical	• Mounting of different types of scales	30		1,2,3,4
	of fish.			
	• Mounting of mouthparts of insects.			
	• Study of various types of social			
	insects (honeybee/ants) and their			
	nests.			

- T1: Anna A. Sher and Richard B. Primack 2019. An Introduction to Conservation Biology, Oxford University press.
- T2: Anon. 2004. Indian Wildlife Protection Act 1972. Natraj Publishers, Dehra Dun. 104p.
- T3: Gopal, R. 1992. Fundamentals of Wildlife Management. Justice Home. Allahabad. 668p.
- T4: Navjot S. Sodhi and Paul R. Ehrlich 2010. Conservation Biology for All. Oxford University press.
- T5: Wilson, E. O., and D. Perlman. 2000. Conserving earth's biodiversity. Island Press, Washington, D.C.

# **REFERENCE BOOKS:**

- R1: Meffe, G. K. and C. R. Carroll 1994. Principles of Conservation Biology, Sinauer Associates, USA
- R2: 2 Michael, P. 1984. Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw Hill Publishing Company Limited, New Delhi. 404 p.
- R3: Peter H. Raven, Navjot S. Sodhi, Luke Gibson, 2013. Conservation Biology: Voices from the Tropics, Willey Online library.
- R4: Odum, E.P. 1996. Fundamentals of Ecology. Natraj Publishers, Dehra Dun 574p. 19. Primack, R. B. 2006. Essentials of Conservation Biology, Sinauer Associates, USA.
- R5: Soule, M. E. 1986. Conservation Biology: The Science of Scarcity and Diversity, Sinauer Associates Inc., USA.

# **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping	
SN	Course Outcome (CO)	Mapped Program Outcome
1	Describe animal kingdom and animal diversity.	1,3
2	Explain animal diversity in Indian context.	1, 3
3	Describe salient features and composition of life forms.	1, 3
4	Analyse adaptations in animal diversity.	1, 3
5	Describe the conservation programs adopted in India for conservation of wildlife.	1, 3, 8

SEMESTER – IV									
<b>Course Title</b>	RESEAI	RCH/DATA ANALY	SIS/D	OCUI	MENT	ATIO	N-R4		
Course code	24MSZO221R	<b>Total credits: 12</b>	L T P S R O/F						С
		0	0	20	8	4	0	12	
Pre-requisite	Nil	Co-requisite	Nil					•	
Programme		MASTER OF SCIE	NCE I	N ZO	OLOG	ξY			
Semester	Fall/ I semester of first year of the programme								
Course	Research Problems in Entomology/Fish Biology and Fisheries/Molecular Cell Biology								
Objectives	is a project-based faculty supervised research course. This course aims to give students							lents	
	hands-on laboratory of	or field experience that	e that can be translated into career fields in						
	Entomology/Fish Bio	logy and Fisheries/Mo	olecula	r Cell	Biolog	y.			
CO1	Students should demo	onstrate critical thinkin	g skill	s throu	ıgh esta	ablishi	ng me	thods t	o test
	a hypothesis;								
CO2	Students can analyse	and interpret results an	nd disc	uss fir	dings.				
CO3	Students should demo	onstrate technical comp	petenc	y and e	ethical	labora	tory co	onduct.	
CO4	Students should be ab	le to synthesize scient	ific lite	erature	to the	ir expe	rimen	ts.	
CO5	Students can effective	ely communicate their	findin	g to a	scienti	fic aud	ience.		

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Students should demonstrate critical thinking skills through	1, 2, 3					
	establishing methods to test a hypothesis;						
2	Students can analyse and interpret results and discuss findings.	1, 2, 3					
3	Students should demonstrate technical competency and ethical	1, 2, 3					
	laboratory conduct.						
4	Students should be able to synthesize scientific literature to	1, 2, 3					
	their experiments.						
5	Students can effectively communicate their finding to a	1, 2, 3					
	scientific audience.						

			SEMESTI	ER – IV	V							
Course Tit	le	ENTOMOLO	GY I (INSECT BIO	LOGY,	ECO	LOGY	AND I	PEST 1	MANA	GEM	EN	T)
Course cod	le	24MSZO222R	<b>Total credits: 2</b>		L	T	P	S	R	O/F		C
			<b>Total hours: 30T</b>		2	0	0	0	0	0		2
Pre-requisi	ite	Nil	Co-requisite					Nil				
Programm	e		MASTER OI									
Semester			Fall/ I semester of first year of the programme									
Course			. To provide the knowledge on morphological and									
Objectives			2. To know the anatomical structure of insects and their role in ecosystem.									
			3. To give knowledge on vector borne diseases, pest control and management.									
CO1		Explain Class Ins	xplain Class Insecta and describe morphology of insects.									
CO2			n pest management		ches.							
CO3			insects in an ecosyst									
CO4			ases caused by inse		their	contro	l meas	ures.				
CO5		_	mechanism of insec									
Unit-No.		Conte	Conta		L	earnin	g Out	come		I	KL	
	Hour											
		General morphology of insects and function:						acqui	re			
	-	ruon: ructure of insect h	and thorax and			knowledge Regarding morphology of				f		
		domen, insect into	*			differe	-	_		L		
		pe of mouthparts.	-			insects		onaug	05 01			
		d their modificati	~			1112000						
		ings, wing structu	· · · · · · · · · · · · · · · · · · ·									
I		ng coupling,	20, 101111111111111111111111111111111111	7								1,2
		Insect eye: structure & function,										
		Receptor organs in insects (Chemo										
		receptors, mechanoreceptors and Photoreceptors,  Sound and light producing organs in										
	Ph											
	• So											
	ins	sects.										
	Inse	ct pest control ar	nd management:			Studer						
		imary control mea				differe			of	pest		
	• Ho	ormonal and Pher	omonal control			manag	ement	S				
II	• Bi	ological control		10							1	1,2
	• Pla	ant resistance to in	isects									
	• Bio	otechnological a	pproach in pest									
		anagement.										
	_	or Ecological Ro				Studer			-	-		
		• Insects as herbivores				differe		of in	sects 1	n an		
		<ul><li>Insect as pollinators</li><li>Aquatic insects</li></ul>				ecosys	tem					
III				10								
""		<ul> <li>Insects as parasites and predators</li> <li>Role of insects in forensic sciences</li> </ul>										1,2
		sect biotic potenti										
		vironmental resist										
	• Ins	sect as human foo	u.									

IV	<ul> <li>Insects of medical Importance:</li> <li>Life cycle, Mode of transmission and epidemiology of major vector borne diseases such as Malaria, yellow fever, kalazar, typhus, plague, filiariasis.</li> </ul>	8	Students will have basic idea on various diseases that are caused by insects and their control measures	1,2
V	<ul> <li>Defense Mechanism in Insects:</li> <li>Behavioural and structural defense,</li> <li>Chemical defense,</li> <li>Coloration defense</li> <li>Mimicry.</li> <li>Adaptation of insects in terrestrial and aquatic environment</li> <li>Insect Behavior:</li> <li>Chemotropism, thigmotropism, hydrotropism, rheotropism, anemotropism, phototropism, anemotropism, geotropism, instinct</li> <li>Protective behaviour: mimicry. Crypsis, warning coloration.</li> <li>Behavioural defence, chemical defence.</li> <li>Breeding behaviour.</li> <li>Insect associations: Passive insect association, active associations, estivating aggregation, protective aggregation, swarming aggregation, sleeping aggregation, dissociation, social aggregations</li> </ul>	10	Students will have understanding on different behavioural mechanism in insects	1,2

- T1: The Insects: Structure and Function. AUTHOR: R. F. Chapman, EDITORS: Stephen J. Simpson, University of Sydney Angela E. Douglas, Cornell University, New York. Cambridge University Press.
- T2: Modern Entomology by D.B. Tembhare. Himalayan Publishing House.

# **REFERENCE BOOKS:**

- R1: IMMS' general text book of entomology by Richard's and Davies (Latest Edition) Chapman and Hall, UK.
- R2: Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F.M (6th Edition). Saunders College Publication, USA.
- R3: Principles of Insect Morphology, Snodgrass, R. E. (Latest Edition). Cornell Univ. Press, USA.
- R4: The Insect Societies, Wilson, E. O. (Latest Edition). Harvard Univ. Press, UK.
- R5: Daly and Doyen's Introduction to Insect Biology and Diversity. Whitfield, J. B. and A. H. Purcell
- R6: III. (3rd Edition). Oxford University Press, Oxford, UK.
- R7: Wigglesworth, V.B. (1976). Insect and the life of Man. London Chapman and Hall.
- R8: Entomology and Pest Management by Pedigo, L.P. and Rics, M.E. (6th Edition). PHI Learning Private Limited.
- R9: Pests of Stored Grains and their Management by Bhargava, M.C. and Kumawat, K.C. (Latest Edition). New India Publishing Agency.
- R10: Insect Pests of Stored Grains and Grains Products: Identification, Habits and Methods of Control by Cotton, R.T. (Latest Edition). Biotech Books, Delhi.
- R11: Fundamentals of Agriculture Entomology by Haldhar and Deshwal. (Latest Edition) New Vishal Publication.

# OTHER LEARNING RESOURCES:

- 1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 2. Online study materials

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain Class Insecta and describe morphology of insects.	1, 6						
2	Illustrate and plan pest management approaches.	1, 6, 8						
3	Describe role of insects in an ecosystem.	1, 6						
4	Describe the diseases caused by insects and their control measures.	1, 6, 8						
5	Explain defense mechanism of insects.	1, 3						

SEMESTER – IV																
Course Tit		IOLOGY II (INSECT PH			GY A	_	OXIC		)							
Course coo	de 24MSZO223R		L	T	P	S	R	O/F		C						
		Total hours: 45T+30P	3	0	2	0	0	0		4						
Pre-requis		Co-requisite					Vil									
Programm	ie	MASTER OF SCI														
Semester		Fall/ I semester of firs	-													
Course		nd the basic concept of inse	_	-			et beha	aviour.								
Objectives	_	he knowledge on pesticides														
		nowledge on different comm														
CO1		docrine system and their in	fluer	nce on	phys	iology	of ins	ects.								
CO2		ogical system of insects.														
CO3		s communication and its si														
CO4		xicity of pesticides and their														
CO5	Identify pesticion	les and explain their mode	of ac	tion in	con	trolling	insec	ts.								
Unit-No.		Content		Conta	ct	Lear	ning	Outcome		KL						
					r											
	Insect Physiology:					Studer	ts wil	l acquire								
	Digestive system, R	espiratory system,						egarding								
I	Circulatory system,	Nervous System,		7		the end	docrin	e system		1,2						
	Reproductive systen	n, Excretory system.				and the	eir infl	uence on	ce on							
						physio	logy o	of insects	.							
	<b>Endocrine system:</b>	Insect hormones-with				Student	s will	able to								
II	reference to metamo	rphosis and reproduction.		10		know a	bout I	Different		1,2						
11	phy						ogical	system o	f	1,2						
						insects.										
	Social insects and	I communication: Social				Students will acquire										
	Insects, Social organ					knowle	edge o	on insect								
	differentiation, Hon	ey bees, Termites and ants		communication and					s							
III	as social insects			10		signific	cance.			1,2						
111	Insect communicat			10						1,2						
	· · · · · · · · · · · · · · · · · · ·	communication, Audio and tactile														
	communication, Vis															
	Luminescent insects															
	Toxicology of pes	ticides: LD50 and LC50,				Studen										
		tionship, Carcinogenic,				basic i										
IV	Mutagenic and Ter	ratogenic effects; Method o	f	8		toxicol				1,2						
	_	on insect and evaluation of				pestici										
	toxicity.					effect o										
	Group characterist					Studen										
		hlorines, Organophosphoru	S			underst		_								
	insecticides,					differe	_	-								
	·	oids, other plant origin bio-	.			pestici										
V	· ·	otinoids and nitrogenous		10		mode o	of action	on.		1,2						
· ·	_	nts; IGRs, attractants,		10												
	_	eedants. Properties of few														
		es i.e. DDT, HCH (BHC),														
		n, Parathion, Malathion,														
	Carbaryl, Cypermetl															
Practical	• Identification and	d classification of		30					1,	2,3,4						

- important organisms from different phylum of animal kingdom.
- Collection, identification and preservation of insects.
- Permanent slide preparation of mouthparts of mosquito, cockroach, butterfly and honeybee.
- Study of various types of social insects (honeybee/ants) and their nests.
- Mounting of legs, antennae and wings (at least of two types).
- Dissection and display of sting apparatus in honey bee.
- Dissection and display of male and female reproductive system of insects.
- Dissection and display of nervous system of cockroach.
- Dissection and display of digestive system of cockroach.
- Dissection and display of Salivary gland of cockroach/ honey bee.
- Dissection and display of Corpora cardiaca of cockroach.
- Dissection and display of bacterial chamber of termite.

# **REFERENCE BOOKS:**

- R1: The Principles of Insect Physiology by Wigglesworth, Vincent B. (7th Edition). Chapman and Hall Ltd. USA.
- R2: Physiological system in Insects by Klowden, M. J. (3rd Edition). Academic Press, USA.
- R3: The Insects, An outline of Entomology by Gullan, P. J., and Cranston, P. S. (5th Edition). Wiley Blackwell, UK.
- R4: Insect Physiology and Biochemistry, Nation, J. L. (4th Edition). CRC Press, USA.
- R5: Social Insects (Vol-III) by Hermann, H.R. (Latest Edition). Academic Press, London.
- R6: Toxicology and Risk Assesssment: A Comprehensive Introduction by Greim H., and Snyder, R. (2nd Edition), John Wiley and Sons, UK.
- R7: The Complete Book of pesticide management by Whitford, F. (Latest Edition). Wiley Interscience, John Wiley and Sons, UK.
- R8: Pesticide Application Methods by Matthews, G, A. (4th Edition) Blackwell Science, London, UK.
- R9: Insecticide Biochemistry and Physiology, Wilkinson, C. F. (Latest Edition). Plenum Press, New York, UK.

# OTHER LEARNING RESOURCES:

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the endocrine system and their influence on physiology of insects.	1, 3					
2	Explain physiological system of insects.	1,3					
3	Describe insect's communication and its significance.	1,3					
4	Describe the toxicity of pesticides and their effects on insects.	1, 3, 8					
5	Identify pesticides and explain their mode of action in controlling insects.	1, 3, 8					

		SEMESTER	– IV							
<b>Course Title</b>	FISH BIO	DLOGY AND FISHERI	ES I (Fi	sh ph	ysiolo	gy a	nd Fi	sh cultu	re)	
Course code	24MSZO222R	Total credits: 2	L	T	P	S	R	O/F	(	С
		Total hours: 30T	2	0	0	0	0	0	1	2
Pre-requisite	Nil	Co-requisite			-1		Nil		I	
Programme		MASTER OF SC	IENCE	IN Z	OOL	OGY	7			
Semester		Fall/ I semester of fi	rst year	of th	e prog	gram	me			
Course	1. To impart kn	owledge on the classifica	tion of m	najor	groups	s of f	ishes a	and their		
Objectives	important ch	aracters.								
	2. Acquire knowledge on fish physiology and fishery management.									
	3. To provide k	nowledge on different fis	h disease	es.						
CO1	Classify fish into	o appropriate groups base	d on thei	r key	chara	cteri	stics.			
CO2	Describe respira	tion and excretion of fish								
CO3	Discuss food and	d feeding habit of fishes a	nd the d	igesti	ve sys	tem	of fish	es		
CO4	Explain types of	fish diseases, their symp	toms and	l cont	rol.					
CO5	Identify orname	ntal fishes of North East	India ar	nd des	scribe	fish	farmi	ng, fishi	ng ge	ears
	and crafts.									
Unit-No.	•	Content	Conta	ct	Lea	rnin	g Out	come	K	L
			Hour							
		and skeletal system					ll learı			
		ers and classifications,		-				stics of		
I		os (extant and extinct).	7		ish alc	-			1	,2
	-	keleton, Skeletal system					n of n	najor		
	• Cardio vascular	-			ish gro					
		excretory system of					ll learı			
	fish				respiration and excretion					
	• Structure and fu	~		11	n fishe	es				
	breathing organs									
II		nd its modifications	10						1	,2
	• Weberian ossicl									
	• Excretion: kidne function	ey, structure and								
		in fresh water and								
	marine teleost.	iii iiesii watei aliu								
	Food and feeding	habit of fishes		C	Studen	te wi	ll learı	1		
	<ul> <li>Food and feeding</li> </ul>				eeding			1		
	Digestive system				ligesti					
		l and its modifications		'	ngesti	011 01	. 11311			
III	<ul> <li>Modifications of</li> </ul>		10						1	,2
		lysis: Index of fullness,								
		and Gastro-somatic								
	index.									
	Fish diseases Dise	ease		5	Studen	ts wi	ll learı	1		
		on, Disease problems.						of fish		
		es: viral, bacterial,				-	_	control		
IV	fungal, protozoa		8		neasur			_	1	,2
		l control measures,								
	• •	Biochemical assay,								
		hniques, vaccines.								
	<i>31</i>	1 /	<u> </u>						<u> </u>	

	Fish culture		Students	will	learn	
	Ornamental fish, culture of ornamental		fisheries n	nanagem	ent	
	fishes, Ornamental fishes of northeast					
	India.					
v	Fish farming: Integrated and composite	10				1,2
•	fish culture	10				
	Fishing gears and Crafts. Preservation					
	and processing of fishes.					
	Fisheries cooperative and their role in					
	fish production and marketing.					

- T1: A textbook of Fish Biology and Fisheries by S.S. Khanna and H. R. Singh (3rd Edition). Narendra PublishingHouse, Delhi.
- T2: The freshwater fishes of the Indian region by Jayaram, K.C. 1999. New Delhi: Narendra Publishing House. 551 pp.

# **REFERENCE BOOKS:**

- R1: Handbook of the freshwater fishes of India by Beaven C R (Latest Edition) Narendra Publishing House.
- R2: Fishery by-products technology by Brody (Latest Edition) AVI, Westport.
- R3: Fish and Fisheries of India by Jhingran V. G. (4th Edition). Hindustan Publishing Corporation.
- R4: Ichthyology by Lagler et al. (2nd edition). Wiley Publication.
- R5: Fish and Fisheries by Pandey (Latest Edition). Rastogi Publications.
- R6: Fishes by Chandy, M. (1st Edition). National Book Trust, India.
- R7: Inland fishes of the India and adjacent countries by Talwar, P.K. and A.G. Jhingran. 1991. Volume 1 and 2. New Delhi: Oxford and IBH Publishing Co.
- R8: Fishes of northeast India by Vishwanath, W., W.S. Lakra and U.K. Sarkar. 2007. Lucknow: National Bureau of Fish Genetic Resources. 264 pp.

# **OTHER LEARNING RESOURCES:**

- 1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 2. Online study materials

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Classify fish into appropriate groups based on their key characteristics.	1, 3						
2	Describe respiration and excretion of fish.	1, 3						
3	Discuss food and feeding habit of fishes and the digestive system of fishes	1, 3, 6						
4	Explain types of fish diseases, their symptoms and control.	1, 6						
5	Identify ornamental fishes of North East India and describe fish farming, fishing gears and crafts.	1, 6, 8						

		SEMESTER – IV									
Course Tit		FISH BIOLOGY A					4.				
C		h reproductive biology, en							7	<u> </u>	
Course coo	ie 24MISZO223R	Total credits: 4 Total hours: 45T+30P	1 L 3	T	P	S	R 0	O/I	1	<u>C</u>	
Dro roquis	ite Nil		3	0	2	0 Nil	U	0		4	
Pre-requis		Co-requisite MASTER OF SCIE	NCF I	N 70	201.00						
Semester	le	Fall/ I semester of first									
Course	1 This course i		•				tive at	nd se	nsc	<b>173</b> 7	
<b>Objectives</b>		. This course is designed to provide in depth knowledge of reproductive and sensory organ of fishes.									
Objectives		2. To develop theoretical knowledge on fishery genetics and fish biotechnology.									
	-	owledge on endocrine system									
CO1	_	s of sensory organs, pattern,									
CO2		roductive organs of fish.									
CO3	•	ne system in fishes.									
CO4	-	difications of hill stream an	d deer	-sea	fishes.						
CO5		enetics and apply bioinfor				for ma	anagin	g da	ta	and	
		ngful information in connec					-0	<i>ي</i>			
Unit-No.		ontent	Cont			ning O	utcon	ie	ŀ	ΚL	
			Hou			0					
	Chemoreceptors and	migration			Studen	ts will	learn				
	•Structure of olfactor	y system, morphology of			Sensor	ry organs					
	peripheral olfactory	organ, cellular			and Mi	gratio	n of fis	h			
	_	tory epithelium, olfactory									
	_	ojections. Structure and									
I	functions of taste b		7						1	1,2	
1	<ul><li>Migration infishes: T</li></ul>	• •	,						,	.,2	
	Catadromous, Amph										
	responsible for migra	,									
	, -	odicity of migration. Role									
	_	ation, Orientation and									
	Navigation during m	-			C ₄ 1		11 1				
	Reproductive system				Studen		ill lea				
	of maturation.	oroductive system. Stages			Reprod of fish		БЮЮ	gy			
	<ul> <li>Mechanism of spern</li> </ul>	natogenesis and its			01 11511	CS					
	•	onado- somatic index,									
II		omatic index and Dobriyal	10	)					1	1,2	
	index.	made mack and Bootiyar									
	• Structure of female 1	reproductive system. Stages									
		nesis, egg development,									
	hormonal control of	oogenesis.									
	<b>Endocrine system</b>				Studen	ts will	acquii	e			
		and functions of pituitary			knowle	_					
III	gland in fishes. Struc		10	,	Endoc	rine sy	stem ii	1	1	1,2	
111	functions of other en	~	10	,	fishes				,	. ,_	
		alamo- hypophysial system									
	in fishes. Neurohorn	nones and their functions.									

	Adaptation in fishes		Students will learn	
	Adaptation in Hill Stream Fishes		Modifications of hill	
TX 7	Adaptations in deep sea fishes	0	stream and deep sea in	1.2
IV	Sexual dimorphism, mating and Parental	8	fishes	1,2
	care. Lateral line system infishes.			
	Larvivorous and exotic fishes.			
	Genetics and bioinformatics		It will help the	
	Genetics, Biotechnology and Aquaculture.		students to get the	
	• Introduction to Bioinformatics: FASTA,		knowledge Fish	
${f V}$	BLAST, Databases	10	Genetics and	1,2
	Application of Bioinformatics in Fishery,		Bioinformatics	
	Barcoding, Genetic diversity and			
	phylogenetics			
	Identification of important indigenous and			
	exotic fishes of NE India representing all fish			
	groups.			
	Biological analysis of fish			
	samples for gut contents (GASI),			
	maturity stages (Gonado-somatic			
	index (GSI), hepato-somatic			
	index (HIS)).			
	Determination of length-weight and length-			
	length relationships.			
	• Determination of Condition Factor (CF),			
	Absolute and Relative fecundity.			
	Identification of fishing gears.			
Practical	Analysis of water samples for	30		1,2,3,4
	various physico-chemical			
	parameters – pH, Free CO2,			
	Dissolved Oxygen, Hardness.			
	Histological study of the fish gonads for stages			
	of maturity study.			
	Identification of important fish parasites			
	(external and internal).			
	Fish osteology: Alizarin preparation of fish			
	skeleton.			
	DNA extraction from fish tissues, gel			
	electrophoresis.			
	• Analysis of gene sequences from databases for			
	phylogenetic and genetic diversity study.			

- T1: A Text Book of Fish, Fisheries and Technology by Biswas K P. (2nd Edition) Narendra Publishing House.
- T2: A textbook of Fish Biology and Fisheries. S.S. Khanna and H. R. Singh. (3rd Edition) Narendra Publishing House, Delhi.

# **REFERENCE BOOKS:**

- R1: Handbook of fish biology and fisheries by (Volume I and II) by Hart P. and Reynold J. D (Latest Edition). Blackwell publishing U.S.A.
- R2: Fish Endocrinology by Matty A. J. (Latest Edition). Croom Helm Ltd., Australia.
- R3: Fishes: An introduction to ichthyology by Moyle P.B. and Cech J. J. Jr (5th Edition). Prentice Hall, New Jersy, U.S.A.
- R4: General and Applied Ichthyology by Gupta S.K., Gupta P.C. (Latest Edition). S Chand and Company
- R5: Handbook of the freshwater fishes of India by Beaven C R. (Latest Edition). Narendra Publishing House.
- R6: Biology of Fishes, Bone, Q. and Moore, R. (3rd Edition) Talyor and Francis Group.
- R7: The Physiology of Fishes, Evans, D. H. and Claiborne, J. D. (5th Edition) CRC Press.
- R8: The Senses of Fish: Adaptations for the Reception of Natural Stimuli. von der Emde, R., Mogdans, J. andKapoor, B. G., (Latest Edition) Narosa Publishing House, New Delhi, India, 2004.

# **OTHER LEARNING RESOURCES:**

1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Explain concepts of sensory organs, pattern, and mechanism of	1,3						
	fish migration.							
2	Describe the reproductive organs of fish.	1						
3	Explain Endocrine system in fishes.	1						
4	Compare the modifications of hill stream and deep sea fishes.	1,6						
5	Explain fish genetics and apply bioinformatics methods for	1, 6, 8						
	managing data and retrieving meaningful information in							
	connection to fishes.							

SEMESTER – IV Course Title MOLECULAR CELL BIOLOGY I											
Course									1	T -	
Course	e code	24MSZO222R	Total cred		L	T	P	S	R	O/F	C
		2.742	Total hour		2	0	0	0	0	0	2
	quisite	Nil	Co-rec		CIENIC		0010	Nil			
Progra				TER OF S							
Semes		1.77. 11.1		emester of							11
Course		1.To Understand	•	•						•	cell
Object	tives	cycle, highlight 2. To Investigate	~				_		•		and
			_			_	_		-	-	
eukaryotic cells, focusing on molecular pathwa function.							na men	impiic	at10115 .	ioi cci	iuiai
			Analyze the molecular basis of cellular processes, including cell proliferation, cell								
		death, and the			_			_	-		
		of multicellula									
C	O1	Describe mitosis			ic cell c	ycle.					
	O2	Explain the proc		-		•	c and er	ıkarvoti	c cells		
	O3	Describe the mo	_	_	_						cell
	~ =	proliferation and			1		- 1110				
C	O4	Explain cell-cel			acellula	r matrix	in the	evolutio	n of m	ulticel	lular
		organisms.									
C	O5	Describe cell pr	ogression ar	nd death.							
Unit-		Content		Contact	Learn	ing Ou	tcome				KL
No.				Hour							
I	Cell d	ivision and cell	cycle		Learners would be able to understand						
	• Mitosi	s and meiosis, the	ir				rgoes di	ivision a	ınd		
	regula	tion		7	regula	gulation					1,2
	• Steps i	in cell cycle									
	• Contro	ol of cell cycle									
II		Expression						ome be a	able to		
		ol of gene express				parallels		_			
		cription and transla	ntion		_		prokary	otic and			
	levels				eukary	otic					
	_	ation of phages, v		10							1,2
	_	yotic and eukaryo	tic gene								
	expres										
		of chromatin in reg	_								
	silenci	xpression and gen	ie								
III		r Communication	n		Learn	ers will	he able	to unde	retand		
111		ral principles of co						l disease			
	communication					ated to g			.5		
		idhesion and roles	of				٠ د				
		ent adhesion mole		10							1,2
		junctions, extra c									,—
	_	x, integrins,	<del>-</del>								
		transmission and i	ts								
	regula										
L				<u> </u>	<u> </u>						

IV	Biology of Cancer  Normal and cancer cells, Cell transformation DNA and tumour viruses Chromosomal basis of human cancer Regulation of cell cycle in cancer progression	8	Students would learn the importance of cell-cell adhesion and the extracellular matrix in the evolution of multicellular organisms.	1,2
V	<ul> <li>Cell Proliferation and Death</li> <li>Factors for cell proliferation</li> <li>Different types of cell death (apoptosis, necrosis and autophagy)</li> </ul>	10	Students would learn how cell undergoes progression and death	1,2

- T1: Cell and Molecular Biology, Lohar (Prakash S), 1st Edition, Mjp Publishers.
- T2: Cell Biology, De Robertis (Edp) & Others, 5th Edition.
- T3: Cell Biology, Genetics, Evolution and Ecology, Edn.3 Part Ii Verma (P.S), Aul. H) Ed. Nch (James); Agarwal (V.K.).
- T4: Cell and Molecular Biology: Concepts and Experiments. Carp Gerald, 1996. John Wiley & Sons Publishers.
- T5: Concept of Cell Biology, Verma (PS); Agarwal (VK), S. Chand & Co Publishers.

# **REFERENCE BOOKS:**

- R1: Cell Biology, Power (C.B), 3rd Edition, Himalaya Publishers.
- R2: Cell Biology, Gupta (M L); Jangir (M L), 1st Edition.
- R3: Cell Biology, Rastogi (S C), 1st Edition, New Age International Limited Publishers.
- R4: A Textbook of Cell Biology, Shukla (R M), 1st Edition, Dominant Publishers.
- R5: Cytogenetics, Swanson (Carl. P) Etc. Prentice Hall Publishers.

# **OTHER LEARNING RESOURCES:**

- 1. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 2. Molecular Cell Biology: https://nptel.ac.in/courses/102/106/102106025/
- 3. Cell Biology: https://nptel.ac.in/courses/102/103/102103012/
- 4. Molecular Cell Biology: <a href="https://nptel.ac.in/courses/102/106/102106025/">https://nptel.ac.in/courses/102/106/102106025/</a>
- 5. Molecular Biology: https://swayam.gov.in/nd2_cec20_ma13/preview

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Describe mitosis, meiosis and eukaryotic cell cycle.	1, 3				
2	Explain the processes of gene regulation in prokaryotic and eukaryotic cells.	1, 3				
3	Describe the molecular basis of cellular processes and the mechanisms that govern cell proliferation and cell death.	1, 3				
4	Explain cell-cell adhesion and the extracellular matrix in the evolution of multicellular organisms.	1, 3				
5	Describe cell progression and death.	1, 3				

	SEMESTER – IV										
Course Ti	tle			CULAR C	ELL BIC		YII				
Course code		<b>24MSZO223R</b>	<b>Total credits:</b>		L	T	P	S	R	O/F	C
			Total hours:		3	0	2	0	0	0	4
Pre-requis		Nil	Co-requ			<del></del>		Nil			
Programn	ne	MASTER OF SCIENCE IN ZOOLOGY Fall/ I semester of first year of the programme									
Semester		1.00			•				.1		
Course	,	1.To understand	-		_						s of
Objectives		eukaryotic cell					_	•	•	•	
		2.To Explore and		_				_			
		and molecular applications.	blology, elli	ipnasiznig	men 10	ie iii	resea	arcii	and t	пегаре	ulic
		3.To Investigate	cell culture to	echniques	cancer th	perani	ec an	d im	munan	aodula:	tion
		strategies, with		-		_					поп
CO1		Explain processe									rvotic
		cell.	at the more	10 101	unuel	Juliu	5 14		01 6	. cunul	. j 0 11 <b>0</b>
CO2		Outline the mole	cular mechanis	ms of cell s	ignalling	pathw	ays.				
CO3		Apply technique						eliver	у.		
CO4		Describe the tech									
CO5		Explain cell cult				and in	nmun	omodi	ılation		
Unit-No.		Content		Contact						ΚL	
				Hour							
		cular mutagenesis			Learner						
		• Site directed mutagenesis			understa			_			
I	1	Sequence tagged sites		7	interacti	on wi	th che	mical	agents	1,2	2
		ONA microarrays									
		mosome painting									
	I	er genetics			To study						
		genitor cells			chemical agents, cancer therapidand immunomodulation.		s				
		cogenes	_	10	and imm	nunom	oduia	tion.			
II	I	nour suppressor g	enes and	10						1,2	2
		ir role in cancer									
		nes for apoptosis	41								
		rinsic and extrinsic gnaling pathway			Learner	C 337;11	ha fan	nilion	with th	9	
		gnanng patnway CR signalling	3						will Ul		
		APkinse		molecular pathways							
III		ceptor tyrosine kin	ase (RTK)	10						1,2	)
111		K-STAT	(1111)	10						1,2	-
	• Ras										
	• NO	NO pathways									
				Students	s will	be fan	niliar v	with			
		NA library			scientifi	c com	petend	cies th	at will		
	• Ger	ne expression ana	lysis (PCR,		allow th			_			
IV	RT-	-PCR and DNA n	nicroarray),	8	molecul				_		2
		LP, RAPD, AFLP			for the s						
	SN	P. DNA Fingerpri	nting		the livin	-	s throu	ıgh m	odern		
					techniqu	ies.					

	Methods of cell and tissue culture		Students will learn animal cell	
	Monolayer and Suspension		culture techniques and cancer	
	culture,		therapies and	
	• Co-culture,		immunomodulation.	
	Cell freezing			
	Biology and applications of stem			
V	cells	10		1,2
	Recent trends in therapy			
	Biomolecules as diagnostic			
	markers and therapeutic agents			
	Gene technology			
	Gene therapy			
	Drug delivery and targeting			
	• Isolation of DNA from goat spleen			
	Estimation of DNA (diphenyl			
	method)			
	• Estimation of RNA (Orcinol			
	method)			
Practical	• UV absorption spectra of native	30		1224
Fractical	and denatured DNA	30		1,2,3,4
	Agarose gel Electrophoresis of			
	DNA			
	DNA amplification by PCR			
	Isolation and analysis of proteins			
	Gel Documentation			

- T1: Cell and Molecular Biology, Lohar (Prakash S), 1st Edition, Mjp Publishers.
- T2: Cell Biology, De Robertis (Edp) & Others, 5th Edition.
- T3: Cell Biology, Genetics, Evolution and Ecology, Edn.3 Part Ii Verma (P.S), Aul. H) Ed. Nch (James); Agarwal (V.K.).
- T4: Cell and Molecular Biology: Concepts and Experiments. Carp Gerald, 1996. John Wiley & Sons Publishers.
- T5: Concept of Cell Biology, Verma (PS); Agarwal (VK), S. Chand & Co Publishers.

# **REFERENCE BOOKS:**

- R1: Cell Biology, Power (C.B), 3rd Edition, Himalaya Publishers.
- R2: Cell Biology, Gupta (M L); Jangir (M L), 1st Edition.
- R3: Cell Biology, Rastogi (S C), 1st Edition, New Age International Limited Publishers.
- R4: A Textbook of Cell Biology, Shukla (R M), 1st Edition, Dominant Publishers.
- R5: Cytogenetics, Swanson (Carl. P) Etc. Prentice Hall Publishers.

# **OTHER LEARNING RESOURCES:**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- 1. NOC: Cell Culture Technologies: https://nptel.ac.in/courses/102/104/102104059/
- 2. Molecular Cell Biology: https://nptel.ac.in/courses/102/106/102106025/
- 3. Cell Biology: https://nptel.ac.in/courses/102/103/102103012/
- 4. Molecular Cell Biology: <a href="https://nptel.ac.in/courses/102/106/102106025/">https://nptel.ac.in/courses/102/106/102106025/</a>

CO PO Mapping				
SN	Course Outcome (CO)	Mapped Program Outcome		
1	Explain processes at the molecular level for understanding functions of a eukaryotic cell.	1, 3		
2	Outline the molecular mechanisms of cell signalling pathways.	1, 3		
3	Apply techniques and methods in cell/tissues culture and drug delivery.	1, 3		
4	Describe the techniques used in molecular biology.	1, 3, 8		
5	Explain cell culture techniques and cancer therapies and immunomodulation.	1, 3, 8		



# **Assam down town University**

# Curriculum and Syllabus

# Master of Science in Microbiology

# OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.2

# **FACULTY OF SCIENCE**

July, 2024

# **PREAMBLE**

Assam down town University is a premier higher educational institution which offers Bachelor, Master, and Ph.D. degree programmes across various faculties. These programmes, collectively embodies the vision and mission of the university. In keeping with the vision of evolutionary changes taking place in the educational landscape of the country, the university has restructured the course curriculum as per the guidelines of National Education Policy 2020. This document contains outline of teaching and learning framework and complete detailing of the courses. This document is a guidebook for the students to choose desired courses for completing the programme and to be eligible for the degree. This volume also includes the prescribed literature, study materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Science held on dated 16th and 17th July, 2024 and approved by the 51st Academic Council (AC) meeting held on dated 26/07/2024.

Chairperson, Board of Studies

Member Secretary, Academic Council

Downey

# Vision

To become a Globally Recognized University from North Eastern Region of India, Dedicated to the Holistic Development of Students and Making Society Better

# **Missions**

- 1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
- 2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
- 3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
- 4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
- 5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
- 6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
- 7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
- 8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

# **Programme Details**

# **Programme Overview**

Master of Science in Microbiology is a 2-year postgraduate programme which deals with more detailed and advanced study of the microorganisms, including microbial cellular processes, their harmful and beneficial aspects, microbes for human welfare, molecular details of microbial cells and develops knowledge and understanding for applying it for societal benefits which may include sectors such as healthcare, agriculture, soil and environment, food processing, pharmaceutical etc. The objective of this programme is to produce intellectual and proficient microbiologists by enhancing the abilities and skills of students for application of microbiology theories and expertise in the live problems faced by the society and various industrial sectors.

# I. Specific Features of the Curriculum

The Master of Microbiology curriculum features core courses in microbial physiology, genetics, molecular biology, and biotechnology, with electives in medical, environmental, and industrial microbiology. It emphasizes hands-on laboratory skills and bioinformatics, and includes a substantial research thesis project along with seminars, workshops, and industry or clinical internships. The program incorporates interdisciplinary approaches, regulatory and ethical training, and develops essential soft skills such as scientific communication and project management. Additionally, it offers global perspectives on health issues and international standards, preparing graduates for diverse careers in research, industry, and healthcare.

The curriculum provides skill enhancement and value-added courses along with the core papers.

# **II.** Eligibility Criteria:

Minimum 45% B.Sc. in (Microbiology/ Biotechnology/ Biochemistry/ Life Science/ Botany/ Zoology/ Agriculture/ Veterinary), MBBS/ Human Genetics etc. 5% relaxation for SC/ST, EWS, and specially abled candidates.

# **III.** Program Educational Objectives (PEOs):

- **PEO 1:** Graduates will be prepared for successful careers in broader aspects of Microbiology in both government and private sectors as microbiologists, QA/QC officers, food analysts, public health officers, food microbiologists, food product developers, food inspectors and allied areas.
- **PEO 2:** Graduates will cultivate adept problem-solving skills, fostering innovative research ideas with a sense of social responsibility.
- **PEO 3:** Graduates will be skilled professionals in microbiology aiding in the holistic development of knowledge creation contributing to the sustainability and progress of science and society at large.
- **PEO 4:** Graduates will be successful in higher education and research in the field of microbiology and interdisciplinary fields if pursued

# **IV.** Program Specific Outcomes (PSOs):

**PSO1 Experiential Learning and Applied Knowledge:** Exhibit an in-depth understanding of the concept of life science specifically in the field of Microbiology and apply the skills and proficiency to address challenges within the domains enabling employment opportunities in the relevant field.

**PSO2** Innovation and Entrepreneurship: Demonstrate scientific temperament and ability to promote a multidisciplinary approach for research exploration and collaboration with professionals across diverse disciplines contributing to innovation and entrepreneurship.

**PSO3** Global certification: Post-graduates gain global recognition through online courses offered by prestigious universities worldwide.

# V. Program Outcome (PO):

**PO1:** Comprehensive Knowledge: Apply comprehensive knowledge of microbial sciences, biochemistry, immunology, biostatistics, molecular and computational biology, ecological principles and microbiological processes to solve biological problems.

**PO2: Problem-Solving:** Identify, formulate, review the literature and evaluate complex biological issues using critical thinking for designing sustainable solutions.

**PO3:** Modern Techniques Usage: Apply standardized protocols, modern analytical techniques, and appropriate tools to execute experiments and conduct rigorous analyses.

**PO4:** Investigation and Research: Leverage research-based knowledge and research methods to design experiments, analyse and interpret data, and synthesize information to draw valid conclusions.

**PO5:** Communication: Communicate proficiently among peers and diverse communities through effective documentation, reports, presentations, talks etc.

**PO6: Professional Ethics:** Integrate professional values and ethics to demonstrate ethical decision-making in the workplace.

**PO7:** Leadership and Teamwork: Contribute effectively as an individual, and as a member within multidisciplinary teams, demonstrating strong leadership abilities in diverse settings.

**PO8: Environment and Sustainability:** Exhibit a sense of environmental responsibility to develop sustainable solutions that prioritize preserving the ecosystem.

**PO9:** Lifelong Learning: Ability to engage in independent and lifelong learning in the broadest context of technological advancement.

# VI. Total Credits to be Earned: 89

# **VII.** Career Prospects:

Upon completing the program, graduates can pursue careers in various fields, including roles as research scholars in R&D laboratories, microbiologists in hospital laboratories, and health officers. They are also well-prepared for positions in food processing industries as microbiologists and quality control officers. Additionally, opportunities abound in the beverage and pharmaceutical industries, as well as in various biotechnological sectors. Graduates can also explore careers in environmental microbiology, bioinformatics, regulatory affairs, and academic or industrial research.

# **EVALUATION METHODS**

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the Programme shall be added to the score of the end-semester examination.

### A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting insemester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

S.N.	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

^{*}are compulsory

Note: Total Internal assessment should be out of 40

# **INSTRUCTION**

- 1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
- 2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
- 3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

# **B. SEMESTER END EXAMINATION:**

Time table for end semester examination is published at least 25 days prior to the start of Examination.

# I. Pre-Examination:

# Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

- i) He/ She is a registered student of the University;
- ii) He/ She is of good conduct and character;
- iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

# II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

# **III. Pattern of Question Papers:**

The question paper shall follow the principles of Bloom's Taxonomy.

Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of all 6 knowledge levels.

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl. No.	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

# **IV. Examination Duration:**

Each paper of 60 marks shall ordinarily be of two hours duration.

# V. Practical Examinations, Viva-Voce etc.:

- i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.
- ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

# VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

### **VII.Instruction to the Students:**

- (i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.
- (ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.
- (iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.
- (iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.
- (v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.
- (vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.
- (vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.
- (viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.
- (ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

# VIII. Provision for an Amanuensis (writer):

(i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.

- (ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.
- (iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

### C. Credit Point:

It is the product of grade point and number of credits for a course, thus,  $CP = GP \times CR$ 

#### i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

### ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

#### iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

- (i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.
- (ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.
- (iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

**Table 2: Letter Grades and Grade Points** 

Letter Grade	Grade Points	Description
0	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
В	6	Above Average
С	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

### iv. Grade Point Average:

### a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$SGPA = \frac{\sum_{i=1}^{n} c_i G_i}{\sum_{i=1}^{n} c_i}$$
 (1.1)

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the ith registered Course and Ci is the Credit (weight) of that Course.

### b. CGPA (Cumulative Grade Point Average)

- (i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.
- (ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$CGPA = \frac{\sum_{i=1}^{N} C_{i}G_{i}}{\sum_{i=1}^{N} C_{i}}$$
 (1.2)

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

### **D.** Post-Examination

### i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

#### ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Reevaluation within 10 days of the declaration of result.

- (i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.
- (ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.
- (iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.
- (iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.
- (v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.
- (vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.
- (vii) Fresh Marks sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.
- (viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.
- (ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

### INSTRUCTION TO TEACHERS AND STUDENTS

### (Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

## 1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

- **a. Project-Based Learning:** The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyse, make decisions, collaborate, and more.
- **b. Inquiry-Based Learning:** The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.
- **c. Flipped Classroom:** About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student- centric teaching method.

**d.** Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

## The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

### Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

# SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code   Course Title   Course		Course		E	Eng	ag	gem	ent			Maximu Marks f		
	N.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	24MSMB1101R	Introduction to Microbiology & Microbial Diversity	DSC Major	3	0	2	0	0	0	4	40	60	100	200
er I	2	24MSMB1102R	Biochemistry	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Semester	3	24MSMB1103R	Bioinstrumentation	DSC Minor	3	0	2	0	0	0	4	40	60	100	200
Sel	4	24UMFS1101R	Fundamental of Statistics	MDC	2	0	0	0	0	0	2	40	60	0	100
	5	24UMPD1101R	Effective Communication (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	6	24UMEC1101	Extra-curricular	Co and extra- Curricular	0	0	0	0	0	0	1	0	0	100	100
		Te	otal								17				900
	S.					Engagement					N	Maximu	m		
	No.	Course Code	Course Title	Course						Marks for					
	110.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	24MSMB1201R	Immunology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	24MSMB1202R	Molecular biology, Genomics and Genetic Engineering	DSC Major	3	0	2	0	0	0	4	40	60	100	200
I	3	24MSMB1203R	Microbial Genetics and Physiology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
ter II	4	24UMPD1201R	Advanced Communication	AEC	0	0	4	0	0	0	2	0	0	100	100
emester	5	24MSMB1204R	Postgraduate Practice Teaching	SEC	0	0	2	0	0	0	1	0	0	100	100
Š	6	24MSMB1205R	Research Methodology and Statistical Analysis	SEC	2	0	2	0	0	0	3	40	60	100	200
	7	24FSDA1201R	Data analysis using MS Excel	VAC	0	0	4	0	0	0	2	0	0	100	100
	8	24MSMB1206R	Field Visit	Field Training	0	0	0	0	0	8	1	0	0	100	100
	9	24UMCC1201		Co and extra Curricular	0	0	0	0	0	0	1	0	0	100	100
		T	otal								22				1300

	S.			Course			Enc	<b>TO</b>	rom.	ont		I	Maximu	m	
	N.	Course Code	Course Title	Cotogory		Engagement		1	Marks f	or					
	17.			Category	L	T	P	$\mathbf{S}$	R	О	С	IA*	SEE*	PE*	Total
	1.	24MSMB2101R	Bioinformatics	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	2	24UMPD2101R	(PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
	3	24MSMB2102R	Internship	Internship	0	0	0	0	0	32	4	0	0	100	100
	4	24MSMB2103R	Field Visit	Field	0	0	0	0	0	8	1	0	0	100	100
	'	2 11/151/1621031	Tiola visit	Training	Ü	Ü	Ü			Ů	•	Ů	Ü	100	100
Ι	_	24242424242	D 1 D 1 1	Research/	0		0					_		100	100
	5	24MSMB2104R	Research Project I	Industry Internship	0	0	8	0	0	0	4	0	0	100	100
Semester	6	24MSMB2105R	Indian knowledge system	VAC	0	0	0	0	0	0	2	0	0	100	100
nes			Discipline specific Elect	ive (Any th	ree	su	bje	ct	s to	be s	elect	ted)	I		I
jen	7	24MSMB2106R	Medical Microbiology	DSE	3	0	2	0	0	0	4	40	60	100	200
			Microbial Ecology and												
	8	24MSMB2107R	Environmental	DSE	3	0	2	0	0	0	4	40	60	100	200
			Microbiology												
	9	24MSMB2108R	Soil and Agricultural	DSE	3	0	2	0	0	0	4	40	60	100	200
		Z-IVISIVIB2100K	Microbiology	DOL	,	Ü		Ů	0	Ü	7	40	00	100	200
	10	24MSMB2109R	Clinical and Diagnostic	DSE											
			Microbiology		3	0	2		0	0	4	40	60	100	200
	11	24MSMB2110R	Organic Farming	DSE	3	0	2	0	0	0	4	40	60	100	200
		1	Cotal								28	<u> </u>			1300
	S.	Course Code	Course Title	Course	Engagement			Maximum Marks for							
	No.	Course Coue	Course Title	Category	L	Т	P	S	R	О	С	IA*	SEE*	PE*	Total
				Research/		_	_						SEE	112	Total
	1.	24MSMB2201R	Research Project II	Industry	0	0	32	0	0	0	16	0	0	100	100
			J	Internship											
		]	Discipline specific Elec	tive (Any tv	vo s	sub	jec	ets	to l	be se	lecte	ed)			ı
1			Industrial Microbiology												
Ste		24MSMB2202R	and Fermentation	DSE	2	0	2	0	0	0	3	40	60	100	200
ne			Technology												
Semester IV		24MSMB2203R	Food and Dairy	DSE	2	0	2	0	0	0	3	40	60	100	200
		24WISWID2203K	Microbiology	DOE	2	U	2	Ů	U	Ü	3	40	00	100	200
		24MSMB2204R	Pharmaceutical	DSE											
			Microbiology		2	0	2	0	0	0	3	40	60	100	200
		24MSMB2205R	Marine	DSE	2	_	2		0		2	10	<b>CO</b>	100	200
		re	Microbiology		2	0	2	0	0	0	3 <b>22</b>	40	60	100	200 <b>500</b>
			otal								89				
		Grai	nd Total								09				4000

^{*}IA: Internal Assessment, SEE: Semester End Examination, PE: Practical Examination

1 Cours	se Title	Introduction	to Microbiolo	gy & Micro	bial D	Diversi	itv				
		Tota	al credits: 4	,6, 60 111161	LT		$\frac{103}{S}$	O/F	С		
Cours	se Code	24MSMR1101R	l hours: 45T	-30P	3 0		0 0		4		
Pre-re	equisite	Nil	Co-requis	site		<u> </u>	Ni	<u> </u>	II.		
Progr	amme	Master of Science in Microbiology									
Semes	ster	Fall/ I sem	ester of first y	year of the I	Progra	mme					
		1. To familiarize the students					to pr	okaryoti	c and		
		eukaryotic cells.									
	ourse	2. To emphasize on distribution, morphology and physiology of microorganisms in									
Obj	ectives	addition to skills in aseptic									
		3.To study the structure, fun		•	_		diff	erent hal	oitats,		
		ecosystem, and microbial a									
C	CO1	Describe the fundamentals			_						
		classification of microorgan organelles.	isins, inicroso	copy, and	structi	ire o	ı pro	кагуонс	cen		
		Demonstrate different steriliza	ition tachnique	es annlicati	on of	micro	hial	oultura	nedio		
	CO2	and staining techniques	mon tecilliqu	es, applicati	OII OI	шсго	וגוטים (	anure II	icuia,		
			different hel	hitata inalud	ing or	troma	onv	ronmont	a and		
C	CO3	Explore microbial diversity in space.	i uniterent na	onais menu	iiig ex	arenne	CIIVI	romment	s and		
C	CO4	Apply the microorganisms for									
	CO5	Explain microbial indicators of	f wastewater,	microbial in	nteracti	ions, a	and bi	ogeoche	mical		
		cycles.									
Unit		Content	Contact	Learr	ning O	utcon	1e	K	L		
No.			Hour								
I History		of microbiology: Theory of	Q	Cummoris	o the	hic	torica	1 1 1	7 2		
I		of microbiology: Theory of	8	Summariz					2,3		
I	spontar	neous generation, germ theory	of	events in	the o	develo	pmen	t	2,3		
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SEMESTER – I

	Enrichment culture techniques,		mixed cultures and pure	
	Preservation, and maintenance of pure		mixed cultures and pure cultures and be able to	
	culture.			
	Definition of media, types of media, uses		isolate pure culture.  Define media and describe	
	of different types of media, basal media,			
	• •		the different types.	
	differential media, selective media,		Explore culture dependent	
	transport media. Cultural & Un-		and culture independent	
	culturable microbes: Culture- dependent		methods for study of	
	approaches for diversity study and their		microorganisms.	
	limitations, Exploration of Un-culturable			
	bacteria: Culture independent molecular			
	methods for identifying uncultivable			
	bacteria, metagenome concept			
III	Environmental microbiology &	10	Explain the concept of	1,2,3,4,5
	<b>Diversity:</b> Concept of microbial		microbial ecology and the	
	ecology,		interactions between	
	Diversity of microbes in terrestrial		microorganisms and their	
	(agricultural and desert soil), aquatic		environments.	
	(fresh water and marine water) and		Identify and describe the	
	animal (cattle, termite and human being),		diversity of microbes.	
	Microbes in extreme environments -		Describe the characteristics	
	thermophiles, psychrophiles, barophiles,		and adaptations of	
	acidophiles, alkaliphiles and halophiles,		extremophiles.	
	organic solvent and radiation tolerant, and		Explain the presence and	
	their potential applications.		significance of	
	Microbiology of air and space.		microorganisms in the air	
			and space.	
IV	Bioleaching – copper, gold and uranium,	10	Discuss the microbial	2,3,5
	Microbial degradation of xenobiotics -		mechanisms involved in	
	petroleum, oil spills, biomagnifications.		bioleaching. Describe the	
	Bioremediation- in-situ and ex-situ,		microbial processes involved	
	Biodeterioration- paper, textile, wood,		in the degradation of	
	metal, Corrosion: – methods of protection		xenobiotics. Understand the	
			concept of bio magnify-	
			cation and its environmental	
			implications.	
			Differentiate in-situ and ex-	
			situ bioremediation	
			techniques.	
			Explain the microbial causes	
			of bio deterioration.	
			Understand the microbial	
			role in corrosion and	
			methods for its prevention.	
V	Wastewater treatment, Bacterial	7	Explain the stages of	1,2,3,4.5
	indicators - DO, BOD, COD, water		wastewater treatment.	
	purification;		Understand the importance	
	Microbial interaction: Competition,		and function of bacterial	
	ammensalism, parasitism, mutualism,		indicators such as DO, BOD,	
1	commensalism, synergism,		and COD. Identify and	

	Biogeochemical cycles – Carbon, Nitrogen, Phosphorus		explain different types of microbial interactions.  Explain the roles of microbes in the Biogeochemical Cycles.	
Practical	<ol> <li>Study of effective Sterilization by physical and chemical method</li> <li>Preparation of bacterial smear and staining (Simple, Grams, negative and acid fast)</li> <li>Preparation of culture media, Measurement of pH</li> <li>Isolation of pure culture – serial dilution, Pour plate Technique, spread plate technique, types of streaking.</li> <li>Fungal staining: KOH Mounting, LPCB</li> <li>Isolation of air microbes by gravity settle method</li> <li>Study of Biochemical test: IMViC, Starch hydrolysis test, catalase test, Oxidase test</li> <li>Bacteriological examination of water</li> </ol>	30	Proficiency in various biochemical tests, isolation and staining techniques for bacterial and fungal identification.	1,2,3,4,5,6

- T1. Gerard J. Totora, Berdell R. Funke, Christine L. Case (2008). Microbiology: An Introduction. 8th Edition, 2004, Publisher. Pearson, Benjamin Cummings,
- T2. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
- T3. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology.
- T4. Ananthanarayanan R. and C.K. Jayaram Panicker. Text of Microbiology. Twelfth Edition, 2022. Orient Longman.
- T5. Jennifer C. Stearns, Michael G. Surette, Julie Kaiser (2019). Microbiology. J Wiley & Sons

### **REFERENCE BOOKS:**

- R1. Dr. R.C. Dubey & Dr. D. K. Maheshwari. (2012). Third Revised Edition. Practical Microbiology. S. Chand and Company Ltd.
- R2. Mette Prætorius Ibba & Katherine Elasky (2018). Basic and Practical Microbiology Lab Manual Practical. Cognella, Incorporated.
- R3. C.P. Baweja. (2012) 4th Edition. Textbook of Microbiology. Arya Publishers
- R4. Subhash Chandra Parija. (2019). Second Edition. Textbook of Practical Microbiology. Ahuja Book Company Pvt. Limited
- R5. Joanne Willey, Kathleen Sandman, Dorothy Wood. (2020). 11th Edition. McGraw-Hill Professional

### OTHER LEARNING RESOURCES:

- 1. https://www.edx.org/learn/microbiology
- 2. https://www.futurelearn.com/courses/introduction-to-microbiology

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Describe the fundamentals of microbiology including historical prospectives, classification of microorganisms, microscopy, and structure of prokaryotic cell organelles.	1, 3, 9					
2	Demonstrate different sterilization techniques, application of microbial culture media, and staining techniques	1, 3, 4, 7					
3	Explore microbial diversity in different habitats including extreme environments and space.	1, 2, 3, 4, 8, 9					
4	Apply the microorganisms for Bioleaching, bioremediation, and bio deterioration.	1, 2, 3, 8					
5	Explain microbial indicators of wastewater, microbial interactions, and biogeochemical cycles.	1, 3, 4, 8					

		SEM	IESTER – I								
Cours	se Title	Micro	bial Genetics and	Physiology	,						
Cours	se code	24MSMR1102R	Total credits: 4 Total hours: 45T-	+30P	<b>L</b> 3	T 0	P 2	<b>S</b> 0	R 0	O/I	F C 4
Pre-re	equisite	Nil	Co-requis	ite	I			Ni	l	1	
Progr	amme	Maste	er of Science in Mi	crobiology							
Semes			ster of first year of		amr	ne					
1. To teach the biological processes that ensures a balance variability of genetic material.  Course Objectives  2. To discuss the application of the knowledge of microbe engineering techniques in order to produce strains applicable 3. To study the structure, function, energy metabolism, mechanisms of microorganisms.					oial e in l	ger biot	netic echi	s a	ınd ogy	gen	etic
C	CO1	Discuss the historical prospect a and gene transfer mechanisms.	nd overview of DN	A, its struct	ure,	, typ	es,	and	rej	plicat	ion
С	02	Describe plasmids, bacteriopha including detection techniques l code, RNA types, and structure;	ike the Ames test	and replica	-		_				
C	03	Analyze the mechanism of trans and the regulation of gene expres	_	tion, associ	atec	l en	zym	ies a	and	fact	ors,
C	04	Explain bacterial and fungal grov	wth kinetics and cel	l cycle.							
C	05	Explore microbial response to en	vironmental challe	nges							
Unit		Content	Contact	Learn	ing	Out	tcon	ne		K	L
No.	Davida	manufa in constitut Discours of	DNA, 12	Vasuulada		- C		DN	Γ.Α.	1.0	1 2
I		pments in genetics: Discovery of j	,	Knowledg structure,		of lica		DN			2,3, 5,6
		res of DNA, Watson and Crick	*	types.	тер	nca	11011	, aı	Iu	٦,٠	,0
	of dsDl	NA, the law of DNA consistency,	and C	Knowledg					oi-		
	_	paradox. Detailed structure of DN		nation and	trai	nspo	oson	ıs.			
		B DNA, Z DNA, Genome organi: karyotes and eukaryotes, enzym									
	_	replication – detailed mechanis									
		onservative replication, rolling									
	method	and bidirectional method	of								
	_	ion. Recombination: reciprocal									
		ciprocal, mechanisms of recombin									
	transpo	y model. Transposons: Classe sable elements, nomenclature									
	_	sable elements, Insertion seque									
	_	nism of transposition. Effect									
	transpo	sition in bacteria. Genetic require	ments								
		nsposition. Gene transfer mechan									
	bacteria	, ,									
		ction –generalized, specialized									
	abortiv	e, sexduction, mapping sination, Molecular mechanism of	of gene								
		byconjugation – genes and pr	-								
	involve										

II	Plasmid: definition and types – F, R, Col, Vir, Ti, Plasmid, plasmid incompatibility. Ti plasmid transfer system and its application in creating transgenics.  Bacteriophages – Lytic development cycle using phages T4 and T7 as models. Lysogenic phage – lambda and P1, M13 and phi X 174, Genetic analysis of phages –complementation and recombination tests with phages.  Mutation – spontaneous and induced, mutagenic agents, replica plating, Ame's test. DNA damage and repair: factors affecting DNA bases, identification and molecular characterization of repair enzymes in photoreactivation, excision, recombination and SOS pathways.  Importance and uses of mutation analysis. Genetic code – their nature, codon, anticodon, Wobble's hypothesis. Structural features of RNA (rRNA, m RNA and tRNA),polycistronic and monocistronic mRNA.	12	Knowledge on Plasmid and its types, Bacteriophages and their life cycle, Knowledge on mutation and Genetic code	1,2,3 4,5
III	Prokaryotic Transcription and Translation: Organisation of transcriptional units and regulation of gene expression, Mechanism of transcription in prokaryotes – structure and function of RNA polymerase, (DNA foot printing), termination and anti-termination – N protein and nut sites in DNA binding proteins, enhancer sequences and control of transcription, ribonucleoprotein, direction of protein synthesis, RNA template, direction with experimental proof, t RnA as adaptor, ribosomes and their organization in prokaryotes, polycistronic m RNA in bacteria, initiation of translation in bacteria, small subunits, accessory factors, SD sequence in bacteria, initiator tRNA, elongation of translation, translocation and termination mechanisms	10	Knowledge on prokaryotic transcription and translation and associated factors	1,2,3 4,5
IV	Cell Growth and Nutrition: Nutrient requirements, growth factors, nutritional categories, physical factors affecting growth.  Bacterial Growth: Bacterial growth curve, growth kinetics, batch, continuous and synchronized culture.  Cell cycle in microbes and generation time, fungal growth patterns	7	Knowledge on bacterial growth patterns and nutrient requirements	1,2,3 4,
V	Physiological Adaptations and signalling: Quorum sensing, Heat- Shock responses, Chaperones proteins, pH homeostasis, osmotic homeostasis.	4	Knowledge on cell signalling by microbes	1,2,3

	1. Gel casting and gel loading	30	Proficiency in DNA
	2. Isolation of DNA (plasmid DNA,		isolation and separation,
cal	Chromosomal DNA, Fungal DNA)		preparation of competent
ıcti	3. Agarose Gel Electrophoresis		cell, transformation
Practical	4. Preparation of competent cell		experiment and screening
	Transformation (Blue-white-screening,		
	Antibiotics resistance screening)		

- T1. Microbial genetics by Maloy et al. 1994, Jones and Bartlett Publishers
- T2. Modern Microbial Genetics. 1991 by Streips and Yasbin. Niley Ltd.
- T3. Microbial genetics by Stanly R. Maloy, John E. Cronan and David Freifelder.

### **REFERENCE BOOKS:**

- R1. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology.
- R2.Molecular Biology of the Gene 4th edition by J D Watson, N H Hopkins, Roberts, Steitz and Weiner.1987. The Benjamin Cummings Publication Co. Inc California.
- R3. Gene VII by Lewin Oxford University Press. 2000
- R4. Molecular Genetics of Bacteria by J W Dale, 1994, John Wiley and Sons

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Discuss the historical prospect and overview of DNA, its structure, types, and replication and gene transfer mechanisms.	1,9						
2	Describe plasmids, bacteriophage life cycles, DNA mutation, damage, and repair, including detection techniques like the Ames test and replica platting. Describe genetic code, RNA types, and structure; its role in protein synthesis.	1, 3, 4, 9						
3	Analyse the mechanism of transcription and translation, associated enzymes and factors, and the regulation of gene expression.	1, 3, 4, 6, 9						
4	Explain bacterial and fungal growth kinetics and cell cycle.	1, 2, 3, 4, 9						
5	Explore microbial response to environmental challenges	1, 2, 3, 4, 8, 9						

			SEMESTI	ER – I							
Course '	Title		Biochen	nistry							
Course	Codo	24MCMD1102D	<b>Total Credits:</b>	4	L	T	P	S	R	O/F	C
Course	Code	24MSMB1103R	<b>Total Hours:</b> 4	45T+30P	3	0	2	0	0	0	4
Pre-requ	uisite	Nil	Co-requ	uisite				Ni	l		
Progran	nmes		Master of So	cience in M	icrobio	ology					
Semeste	er	F	all/I Semester o	f First Year	of the	Prog	gran	1			
Cour Objecti		<ol> <li>To study the structure of biomolecules, such as proteins, nucleic acids, carbohydrates and lipids</li> <li>To know the functions and interactions of biomolecules, which will provide the knowledge of the structure of cells and the various functions performed by them which are associated with life?</li> <li>To study the metabolic pathways of biomolecules like carbohydrate, amino acids etc.</li> </ol>									
СО	1	Improve the concept of macromolecules	of chemical inter	ractions and	molec	ular	orgai	nizatio	on of	micro	and
CO	2	Understand the compo	sition, structure a	and function	of the	biom	olecı	ıles			
СО	3	Enhance the understan	ding on metaboli	sm and phys	iology	of ce	ell.				
CO	CO4 Analyse the concepts of secondary metabolites for human benefits.										
	Prepare the base for understanding courses such as molecular biology and confunctioning at molecular level.							id cell	ular		
Unit									KL		
No.				Hour							
I		cept of biomolecules		10	Know	_			_		1,2
		cture and functions): (	•		biomo					_	
		eins, Lipids, Nucleic ac	eids, Vitamins		the various biomolecules						
	and r	Minerals.			with thorough understanding on their types and functions						
II	Rige	nergetics: Conc	ept of	10	Demo						
		nodynamics (entropy,	_	10	know						1,2
		energy), reaction kine	~ *		and e	_			_		-,-
		phorylation and	oxidative		for	un	derst	andin	g	of	
	phos	phorylation, <b>Enzymolog</b>	y: Principle of		metab	olisn	n an	d lear	ning	its	
		ysis, enzyme and enz	•		applic			clini	ical a	ınd	
	-	me regulation, mechani			therap	eutic	cs.				
	catal	•	enzymes in								
777		nosis and therapy.		10	D '11	1	1	1	<u> </u>	.1	1.0
III		abolism of biomolecules oohydrate metabolism:		10	Build bioch		owle	•		the of	1,2
	its		uconeogenesis,		synthe				•		
		-	cle, Pentose		the c			-			
	•	phate pathway, glyoxala			with i		-		_		
		d metabolism: oxidatio					-	•			
and unsaturated fatty acid, odd chain fatty			dd chain fatty								
		regulation of fatty acid									
IV		no acid metabolism: T	•	8	Under						,2,3
		nination and its types, ur	-		and n			-			
	Nucl	eotide metabolism: bio	osynthesis and		degra	datio	n	with	1	its	

	degradation of purines and pyrimidines		biochemical and regulatory concept	
V	Heme Metabolism and Photosynthesis	7	Learn the synthesis and	1,2,3,
	and Secondary metabolites:		breakdown of heme, gain	4
	Heme synthesis and degradation,		knowledge on the	
	Photosynthesis: Structure of chloroplast,		mechanism of	
	light reaction and dark reaction, Brief		photosynthesis and apply the	
	concept on the secondary metabolites		concept of secondary	
	(Flavonoids, terpenoids, phenolic acids and		metabolites for mankind.	
	alkaloids)			
	Buffers: Preparation of acetate buffer,	30	To apply the practical	1,2,
	citrate buffer, tris buffer, phosphate buffer;		knowledge of biochemistry	3, 4
	Estimation of protein by Lowry's/Bradford		in various fields	
	method. Estimation of reducing sugar by			
<del> </del>	DNS method.			
Practical	Estimation of RNA by orcinol method.			
rac	Estimation of DNA by diphenyl amine			
4	method, Extraction and estimation of			
	chlorophyll. Determination of total activity			
	of amylase. Determination of total activity			
	of protease, Qualitative analysis for protein,			
	carbohydrate and its types, amino acid.			

T1. U Satyanarayana. Biochemistry. 13th edition. Elsevier Health Sciences; 2017.

### **REFERENCE BOOKS:**

- R1. David L. Nelson, Michael Cox. Lehninger Principles of Biochemistry. 7th Edition. WH Freeman; 2017.
- R2. Rodwell et al. Harper's Illustrated Biochemistry. 29th edition. McGraw Hill; 2012.
- R3. Voet and Voet. Biochemistry. 3rd edition. John Wiley & Sons, 2004.

## **OTHER LEARNING RESOURCES:**

1. https://pubmed.ncbi.nlm.nih.gov/34809432/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Improve the concept of chemical interactions and molecular organization of micro and macromolecules	1,3						
2	Understand the composition, structure and function of the biomolecules	1, 4						
3	Enhance the understanding on metabolism and physiology of cell.	1,3,4						
4	Analyse the concepts of secondary metabolites for human benefits.	1, 2, 7						
5	Prepare the base for understanding courses such as molecular biology and cellular functioning at molecular level.	1, 9.						

			SEMESTER	_ <b>I</b>								
Course	e Title		Bioins	strumentat	ion							
Course	e code	24MSMB1104R	Total credits: 4		L	T	P	S	R	O/F	C	
			Total hours: 45T+		3	0	2	0	0	0	4	
Pre-re	quisite	Nil	Co-requisi	ite				N	il			
Progra	ımme		Master of Sci	ience in Mi	crobi	iolog	y					
Semest	ter		Fall/ I semester of f	irst year of	f the l	Prog	ram	me				
Co	ourse	1. To impart knowledge about the working of different Biomedical Instruments.										
	ectives	2. Basic working principle of different instruments.										
		3. Working principle of chromatography, centrifugation  Discuss Chromatography techniques including history, classification, principles,										
C	CO1	operation, analysis		meruanig	msu	ory,	Clas	SIIIC	ation,	princ	ipies,	
			ation techniques,	classificatio	n, p	orinc	iples.	, op	eratio	n and	d its	
	CO2	application.			1		•					
(	203	Explain and investigate Electrophoresis, its categorization, underlying principle,										
		operational methods, pH meter functionality, dialysis, and blotting methodologies.										
C	CO4		Discuss radioisotope dating principles, including detection, measurement, isotopes,									
		radiation, units and	decay. ehensive understand	ing of princ	rinles	and	nrac	rtical	annli	cation	skille	
C	CO5	• •	copic methods for sc	•	•	, and	prac	ııcaı	аррп	cation	SKIIIS	
Unit		Content		Contact		Lear	ning	Out	come		KL	
No.				Hour								
I		tography: History		10	Abl		to		lescrit		1,2	
		principles, operatio	* *					_	lain t			
	-	(Paper, Column, A Thin layer, Ion exc	_				romatography and their oplications			eir		
		ange, and Gel Chrom			иррпеционз							
II		gation: Types; App		10	Able to describe					be,	1,2	
	rotors;	density gradient	& analytical		illustrate and explain the				he			
	centrifug			_		trifug						
III			plication; Types;	8	Abl		to		lescrib		1,2	
	_	; pH meter (Pri technique: South	nciple); Dialysis, ern Western &				and	_	lain t	ne		
	Northern		om, wostem, &			торі	10103	10				
IV		sotope dating techn	ique: Introduction,	7	Abl	e	to	Ċ	lescrit	be,	1,2	
	nature,		measurement of					•	lain t	he		
		vity, radioisotopes	& radiation, units,		radi	o iso	tope	S.				
V		ve decay.	g. Introduction	10	Abl	0	t c	نہ ۔	المحصية ا	<u> </u>	1.2	
•	Spectros Principle	copic technique and application of sp		10			to and		lescrit lain t		1,2	
	Timespie	and application of s	эссиовоору				cope	. Слр	-uiii l			
	Operation	n of molecules from	given sample by	30	Abl			ise	vario	us 1,	2,3,4	
al	1. Paper	per chromatography			inst	rume	nts f	or an	alysis			
Practical		in chromatography										
Pra		ayer chromatography										
	_	ntion of DNA and prophoresis										
<u> </u>	ger electi	орногозія		]								

T1. Upadhyay. Biophysical chemistry: principle and technique. 12th edition. Himalaya Publishing House Pvt. Ltd; 2017.

### **REFERENCE BOOKS:**

- R1. Kakkar. Atomic and Molecular Spectroscopy. 1st edition. Cambridge English; 2017.
- R2. Evans. Handbook of Chromatography. 2nd Edition, Willford Press; 2019.
- R3. Holme and Peck. Analytical biochemistry. 3rd edition. Longman, 1983.

## **OTHER LEARNING RESOURCES:**

1. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromatography

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Discuss Chromatography techniques including history, classification, principles, operation, analysis and application.	1, 3, 4
2	Define Centrifugation techniques, classification, principles, operation and its application.	1, 3
3	Explain and investigate Electrophoresis, its categorization, underlying principle, operational methods, pH meter functionality, dialysis, and blotting methodologies.	1, 3, 4
4	Discuss radioisotope dating principles, including detection, measurement, isotopes, radiation, units and decay.	1, 3, 4
5	Develop the comprehensive understanding of principles, and practical application skills in various spectroscopic methods for scientific analysis.	1, 3, 4

			SEMESTER –	[					
Cou	rse Title		Fundamental of S	Statistics					
Cou	rse code	24UMFS1101R	Total Credits: 3 Total Hours: 30T-		L T 2 0		S R 0 0	O/F	7 C
Pre-	requisite	Nil	Co-requisite	!		Ni	il		
Prog	grammes		Master of Science	e in Biote	echnology				
Sem	ester	Fal	ll/I Semester of Firs	t Year of	the Progr	amme			
	Course .jectives	<ol> <li>Help to understand the role of statistics in data analysis, decision-making, and scientific research</li> <li>Introduce students to descriptive statistics, including measures of central tendency (mean, median, and mode) and measures of dispersion (range, variance, standard deviation).</li> <li>Teach students how to summarize and present data effectively using tables, charts, and graphs</li> </ol>							
	CO1	Improve understandin	g of Descriptive Stat	istics and	Demograp	hy.			
	CO2	Develop knowledge t methods.							
	CO3	Develop knowledge t data analysis.	o understand the me	thods for	hypothesi	s testing	g and l	Biolog	ical
	CO4 Develop knowledge to understand the principles of various statistical analyses of data.								
	CO5	Develop knowledge o	n R language for data	a analysis	_				
Unit No.		Content			Learning Outco			ne	KL
I	Statistics, sample. Da	Methods: Definition concepts of statistical tax: quantitative and quascales of measurement duratio.	d population and alitative, attributes,	5	Foundat Understa of Statis	anding	oncept	S	1,2
II	histogram Tendency: Dispersions deviation,	on: tabular and gra and ogives. Meas mathematical and posit range, quartile standard deviation, kewness and kurtosis.	ures of Central tional. Measures of deviation, mean	5	Proficier Presenta	•		Data ysis	1,2
III	partial and rank correl	data: Definition, scatted multiple correlation of ation. Simple linear rests and exponential curves	(3 variables only), gression, fitting of	5	Knowled Bivariat Relation	e D	Analy ata	sing and	1,2
IV	space, ever mutually ex of probab- approach. probability probability Normal probability	xperiment: trial, sample ont, Operations of Evacusive and exhaustive ility: classical and a Discrete probability sponsore, Independence of experimental and compound probability Distribution, Poin, Bayes' theorem and its control of the control of	rents, concepts of events. Definition relative frequency bace, Properties of events, Conditional probability rules, tion, Bionomial esson Probability	8	Understa Probabil Distribu	ity		of and	1,2

V	<b>Testing of hypothesis</b> , parametric test: t-test, z-test,	7	Application of Hypothesis	1,2
	chi-square test. Non-Parametric test: One sample		Testing and Statistical Tests	
	Kolmogorov test, wilcoxon Signed test, Mann-			
	Whitney Test, Kruskal walis test.			
	Whitney Test, Kruskal walis test.  1. Introduction to R - A programming language and environment for data analysis and graphics. Syntax of R expressions: Vectors and assignment, vector arithmetic, generating regular sequence, logical vector, character vectors, Index vectors; selecting and modifying subsets of dataset  2. Data objects: Basic data objects, matrices, partition of matrices, arrays, lists, creating and using these objects; Functions- Elementary functions and summary functions, applying functions to subsets of data. Data frames: The benefits of data frames, creating data frames,	30	A brief knowledge on using R for data analysis and visualization	1,2, 3,4
Practical	combining data frames, Adding new classes of variables to data frames; Data frame attributes.  3. Importing data files: import. Data function, read. Table function; Exporting data: export. Data function, cat, write, and write. Table functions, function, formatting output - options, and format functions; Exporting graphs -export. Graph function. Graphics in R: creating graphs using plot function, box plot, histogram, line plot, steam and leaf plot, pie chart, bar chart, multiple plot layout, plot titles, formatting plot axes; Visualizing the multivariate data: Scatter plot, Q-Q plot, P-plot.  4. Performing data analysis tasks: Reading data with scan function, exploring data using graphical tools, computing descriptive statistics, one sample tests, two sample tests, Goodness of fit tests.  5. Parametric test and Non-Parametric test			

T1. Methods in Biostatistics by K S Negi, ISBN: 9789374735053, 4th Edition, Year: 2023, AITBS Publishers, INDIA

# **REFERENCE BOOKS:**

R1."Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig R2. "Statistics" by David Freedman, Robert Pisani, and Roger Purves

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Improve understanding of Descriptive Statistics and Demography.	1, 4					
2	Develop knowledge to understand the Probability theory, Distribution, and sampling methods.	1,4					
3	Develop knowledge to understand the methods for hypothesis testing and Biological data analysis.	1, 4					
4	Develop knowledge to understand the principles of various statistical analyses of data.	1, 4					
5	Develop knowledge on R language for data analysis	1, 4, 9					

	SEMESTER – I									
Course Title	MINI I	RESEARCH (REVIEW OF								
Course code	24MSMB1105R	<b>Total Credits: 2</b>	L	T	P	S	R	O/F	C	
Course code	24WISWIDTIUSK	Total Hours: 120 (S+R)	0	0	0	4	6	0	2	
Pre-requisite	Nil	Co-requisite				Nil				
Programmes		Master of Science in Biot	echn	echnology						
Semester	Fal	l/I Semester of First Year of	the l	Progi	ramm	ie				
Course Objectives	<ol> <li>To develop the ability to conduct a comprehensive literature review and identify the relevant sources</li> <li>To enhance students' ability to critically analyze existing literature and summarize it.</li> <li>To develop students scientific writing skill</li> </ol>								•	
CO1	Employ databases an effectively	d library resources to gather o	origin	al res	earch	, boo	ks, aı	nd artic	cles	
CO2	Summarize and diffe and descriptive review	rentiate between various type ws.	s of 1	eviev	ws, sp	ecific	cally	analyt	ical	
CO3	Identify research top information.	ics and employ appropriate r	netho	ds fo	or coll	lectin	g and	d filter	ring	
CO4	Critically analyze the their contributions an	demonstrations and findings dinsights.	of pr	eviou	ıs aut	hors t	to co	mpreh	end	
CO5	Compose a detailed chosen study.	review that explains the pro	spect	s and	l futu	re dii	rectio	ons of	the	

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Employ databases and library resources to gather original research, books, and articles effectively	1, 2, 3, 4						
2	Summarize and differentiate between various types of reviews, specifically analytical and descriptive reviews.	1, 2, 3, 4						
3	Identify research topics and employ appropriate methods for collecting and filtering information.	1, 2, 3, 4						
4	Critically analyse the demonstrations and findings of previous authors to comprehend their contributions and insights.	1, 2, 3, 4						
5	Compose a detailed review that explains the prospects and future directions of the chosen study.	1, 2, 3, 4,6						

SEMESTER – I											
Cours	se Title	EFFECTI	•	ISH (Comm							
Cours	se code	24UMPD1101R	Total Use		L 0	T 0	P 4	S 0	F 0		C 2
Pre-re	equisite	Nil	Total Hou	equisite	U	U	4		U Nil	0	
	ammes	1111		r of Science	in Bio	otech	nolo		111		
Semes		Fa		ter of First Y					me		
	course jectives	<ol> <li>To introduce the types of sentences and their significance.</li> <li>To strengthen the students' vocabulary to enhance their speaking and writing skills.</li> <li>To familiarize the students with the importance of dress codes in various organizations.</li> </ol>									
	CO1	Analyze and identify	the differen	nt types of se	entenc	es.					
CO2 Able to integrate the skills of reading and speaking in profession						siona	l cor	nmunicatio	on.		
	CO3	Illustrate code Etique	ette sessions	s will boost tl	heir co	onfid	ence	and r	nora	ls.	
	CO4	Describe about the ex	ffective and	efficient util	lizatio	n of	time.				
	CO5	Explain the concep 'pronunciation	t of Phon	etics and its	s imp	ortai	nce	will i	mpr	ove the l	earners
Unit No		Content	Lea	rning	g Ou	tcom	e		Contact Hour	KL	
I	Grammar: Interchange of Interrogative and Assertive Sentences, Exclamatory and Assertive Sentences, Types of Tenses, Common Errors, Synonyms, Antonyms, Homonyms			structure assertive	sente hance	nterro nces.	ogativ Tra gram	e an insfor matic	m al	10	1,2
II				Develop reading comprehen ability to textual systematic	reca	vith and	nd o		er he ze	15	1,2
III	Listening Skills: What is listening?, The Process of Listening, Factors that adversely affect Listening, Difference between Listening and Hearing, Purpose and Importance of Effective Listening, How to Improve Listening Process.			listening. It also helps to enhance interpersonal and professional communication by practicing					10	1,2	
IV	Definition Manager Manager		Conflict Conflict eal with	Learn stra resolve co encourage environme into opport	onflict	a turn	fective of the second s	vely positi onflic	to ve	10	1,2

V	Time-Management Skills	Enhance productivity and stress	15	1,2
	Introduction To Time Management,	management through effective		
	Purpose And Importance of Time	time allocation and planning. It		
	Management, Basic Tips to Maintain	helps to understand the		
	Time.	importance of time management		
	Activity: Problem solving activity: A	in achieving personal and		
	situation will be given to the students	professional goals.		
	and they will have to tell us how to			
	handle the situation or solve the			
	problem.			

- T1. Wren, P.C and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
- T2. English Grammar in Use, Raymond Murphy 4th edition, CUP.
- T3. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.

## **REFERENCE BOOKS:**

- R1. English Vocabulary in Use (Advanced), Michael McCarthy and Felicity, CUP.
- R2. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearsons.

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Analyse and identify the different types of sentences.	1, 5
2	Able to integrate the skills of reading and speaking in professional communication.	1, 5, 9
3	Illustrate code Etiquette sessions will boost their confidence and morals.	5, 6, 9
4	Describe about the effective and efficient utilization of time.	5, 9
5	Explain the concept of Phonetics and its importance will improve the learners 'pronunciation	1, 5, 9

	SEMESTER – II											
Cot	ırse Title			Immunolo	gy							
Cor	ırse Code	24MSMB1201R	<b>Total Credits:</b>			L	T	P	S	R	O/F	+
	• • •		Total Hours: 4			3	0	2	0	0	0	4
	-requisite	Nil		equisite	<u> </u>				Nil			
	grammes			Science in N								
Sen	Semester Spring/II Semest											
	Course bjectives	<ol> <li>To make students understand the Immune system and its components, immune response, antigen, antibody, immunity, Hypersensitivity, Autoimmunity etc.</li> <li>To make students learn various immunological diagnostic techniques</li> </ol>										
	CO1	Describe the immur mechanisms.	ne system and its	s componen	ts and t	heir	mod	de of	actio	n in	defe	nse
	CO2	Outline antigen and monoclonal and poly	clonal antibody	production						_		
	CO3	Apply the knowledg interpretations aiding	•	U	_					rinci	iple, a	and
	CO4	Interpret transplantat	ion and cancer in	nmunology	findings	and	l thei	r role	in res	searc	ch.	
	CO5	Discuss immunolog prevention strategies			mmunit	y a	and	hype	rsensi	tivit	y, th	neir
Unit No.		Content		Contact Hours	Le	arni	ing C	Outco	me		KI	
II	I Introduction to immunology – Definition, history, scope of immunology. Overview of the immune system-cells and organs of the immune system. Immune response- Humoral and cell mediated immune response. Immunity- types of immunity- Innate and acquired immunity, APC.  II Antigens – General features, haptens, adjuvants, epitopes. Antibody – Structure,				Know and t	ne re	ge o	n an pertie	s an	s d	1,2	2
	opsonisation ADCC, iso Antibody production immunoto antibodies genes- an Immunog	antibodies, extraction of nmunoglobulin s switching of	10	along produ purific	ction	with non pro	h	thei an	r d	1.2		
III	applicatio Immunofl	ntigen-antibody interaction – principle and oplication – RIA, ELISA, Western blotting, mmunofluorescence, Complement system – assical and alternative pathway, functions		knowledge on princip						e it	1,2	2
IV	typing, Minmunolo	heories of antibody for the HC, T cell receptors, gy — Graft rejected the therapy, immune to action	Transplantation tion, immune	8	Know tation immu	in	nmun	ology	_		1,2	2

	Immune effectors – Cytokines, IL and functions, cell mediated cytotoxicity, NK cells, TNF, Interferons, Inflammation, leukocyte activation, and migration			
V	Hypersensitivity and types, Autoimmunity, Cancer and immune system – tumor antigen, tumor evasion and immunotherapy of cancer, AIDS – primary and secondary immunodeficiency. Vaccines and its types	10	Knowledge on Hyper- sensitivity, Autoimmunity, cancer immunology, immunodeficiency and vaccines	1,2
Practical	Precipitation Reaction: i. Double Diffusion Reaction ii. Single Diffusion Reaction iii. Ouchterlony immunodiffusion iv. Immunoelectrodiffusion Agglutination Reaction: (Qualitative and quantitative) WIDAL, ASO, VDRL, RPR, CRP Blood grouping and Rh typing, ELISA	30	Able to operate ELISA, RIA	1,2, 3,4

T1. Punt et al. Kuby Immunology 18th Edition. W H Freeman & Co (Sd); 2018.

## **REFERENCE BOOKS:**

- R1. Abbas. Cellular and Molecular Immunology. 10th edition. Elsevier; 2021.
- R2. Martin et al. Roitt's Essential Immunology (Essentials). 13th edition. Wiley-Blackwell, 2017.
- R3. Westwood. Practical Immunology. 4th edition. Wiley-Blackwell; 2002.

## **OTHER LEARNING RESOURCES**:

1. https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the immune system and its components and their mode of action in defense mechanisms.	1, 2, 9							
2	Outline antigen and antibody structure, types, and properties including the processes of monoclonal and polyclonal antibody production	1, 3, 4							
3	Apply the knowledge of different immunological diagnostics tests, their principle, and interpretations aiding in the detection of the underlying cause of the diseases.	1, 2, 3, 4							
4	Interpret transplantation and cancer immunology findings and their role in research.	1, 2, 4							
5	Discuss immunological disorders like autoimmunity and hypersensitivity, their prevention strategies, and management.	1, 2, 3, 4							

			SEMESTER – II								
Cour	se Title	Molecul	ar Biology, Genomic	s And (	Genetic I	Engii	neer	ing			
Cour	rse code	24MSMB1202R	Total Credits: 4 Total Hours: 45T+.	30P	L 3	T 0	P 2	S 0	R 0	O/F 0	C 4
Pre-i	requisite	Nil	Co-requisi	ite				Ni	l		1
Prog	rammes		Master of Science	in Mic	robiolog	y					
Seme	ester	Sprin	g/II Semester of Firs	t Year	of the Pr	ogra	mm	e			
Course Objective:  1. To teach in depth about genome and its 2. To teach the central dogma of life (rep transcriptional modifications) with (explanation/power point presentation attention. 3. Important topics like mutation, DNA da					, transcri best p ar/assign	ptior ossil ment	n, tra ble t) a	nsla tea nd	ntion nchin with	and p	oost
	CO1	Explain the fundamer proteins and the centr		epts sucl	h as geno	ome,	DNA	A str	uctu	ire, RN	NA,
	CO2	Explain the methods different types of or shotgun sequencing.						_		-	
	CO3	Compare prokaryotic chromosomal DNA a expression and regula	nd examine the vital			_	•				
	CO4	Illustrate the dynamic heterochromatin, ch acetylation, DNA mo regulation in both pro	nromosome painting	g, nucl thylation	leosome	mo	odifi	catio	ons,	hist	one
	CO5	Discuss the mutation crucial for maintainin	causes, types of DN	A muta				•	med	chanis	ms,
Unit	Content			СН	Learni	ng O	utco	me			KL
No.											
I	structure an	n to genomics, definition d composition, RNA and I the proteome, the cent	d the transcriptome,	7	Introdu and ref unders	reshi	ing t		wled xisti	_	1,2
II	basis to gen types of org	genomes, markers for getic mapping, linkage a sanisms, physical mapping shotgun sequencing	nalysis with different	10	Sequer detail f mappin	follov			•		1,2
III					Knowle replicat and euk emphas and enz	ion caryo	in jotes v	with ne p	aryo speo prote	cial	1,2
IV	Accessing to heterochron modification modification genome expression methylation eukaryotes	8	Genom discuss various events regulat	sed is	in c st tr alon	letai ansl g	l w ation	ith	1,2		

V	Introduction to genetic engineering, Different DNA	10	Understand genetic	1,2
	manipulating enzymes, methods for isolating DNA,		engineering techniques, use	
	vectors for bacteria, plant and animals, expression		vectors, evaluate expression	
	vectors, DNA libraries, application of genetic		vectors, and propose	
	engineering.		innovative applications.	
	Isolation of genomic DNA, Isolation of plasmid	30	Knowledge on extraction of	1,2,
=	DNA, Polymerase chain reaction, and Endonuclease		DNA and plasmid from	3,4
Practical	digestion of DNA and analysis of DNA fragments		biological samples followed	
rac	by agarose electrophoresis.		by their in vitro	
P			amplification and studying	
			RFLP profile	

T1. Watson et al. The Molecular Biology of the Gene. 7th edition. Pearson Publication; 2013.

### **REFERENCE BOOKS:**

- R1. Alberts et al. The Molecular Biology of the Cell. 7th Edition. WW Norton & Co, 2022.
- R2. Rastogi. Cell and Molecular Biology. 4th edition. New Age International Private Limited; 2020.
- R3. Som. Practical Manual of Molecular Biology. 1st edition. KAAV Publications, 2018.

## **OTHER LEARNING RESOURCES:**

1. https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Explain the fundamental of genomics concepts such as genome, DNA structure, RNA, proteins and the central dogma.	1,9
2	Explain the methods for mapping genomes, describe markers, linkage analysis with different types of organisms, physical mapping, and basics of genome sequencing, shotgun sequencing.	1, 2, 3, 4, 6, 9
3	Compare prokaryotic and eukaryotic genomes, including the presence of extra chromosomal DNA and examine the vital function of DNA binding proteins in gene expression and regulation.	1, 2, 3, 4, 6, 9
4	Illustrate the dynamics of genome access, encompassing aspects such as euchromatin, heterochromatin, chromosome painting, nucleosome modifications, histone acetylation, DNA modifications, DNA methylation-induced gene silencing, and gene regulation in both prokaryotes and eukaryotes.	1, 4, 9
5	Discuss the mutation causes, types of DNA mutation and DNA repair mechanisms, crucial for maintaining genetic stability and impacting human health.	1, 2, 7, 9

SEMESTER – II									
Course Title		Bioinformatics							
C	24MCMD1202D	Total Credits: 3	L	T	P	S	R	O/F	C
Course code	24MSMB1203R	Total Hours: 30T+30P		0	2	0	0	0	3
Pre-requisite	Nil	Co-requisite				N	il		
Programmes	Master of Science in Microbiology								
Semester	Spring/II Semester of First Year of the Programme								
	1. To search and retrieve biological information from different biological databases.								
Course	2. Knowledge on computational database management system and its application in								n in
Objectives	Biology								
	3. A basic idea on the st	ructural biology using computer.							
CO1	A basic concept on Bio	informatics and its significance	in th	ne fi	eld (	of b	iolo	gical d	lata
COI	analysis								
CO2	Knowledge on database	management system and its appl	licat	ion i	in B	iolo	gy		
CO3	A good knowledge on s	equence submission tools as well	as t	oiolo	ogica	al se	earch	n engir	nes
CO4	Knowledge on sequence	e alignment and analysis.							
CO5	Learn the concept of co	mputer aided drug designing							

Unit No.	Content	Contact Hours	Learning Outcome	KL
I	Introduction to Bioinformatics, Scope and Applications of Bioinformatics, Introduction to various molecular data and databases, Importance of Computers/IT in the field of Biology. Flatfile formats. Biological Database and its Types - General Introduction of Biological Databases: Nucleotide sequence databases (NCBI, DDBJ, and EMBL).Protein sequence databases(SWISS-PROT, PIR, GenPept) ,Specialized Genome databases: (SGD, TIGR etc).Structure databases (CATH, SCOP, and PDB, NDB, MMDB)	7	Knowledge on bioinformatics and its relation with molecular biology and its application.	1,2
II	Database Management System: Basic Concept of DBMS, Concepts of Entities, Attribute, Keys, Relationship. Three level architecture of a DBMS, Structure of a DBMS, Advantages & Disadvantages of a DBMS.File Based System, Traditional System, DBMS types Hierarchical, Network, Relational Data Model etc	6	Formation of a database and its application in biology	1,2
III	Bioinformatics Database search engines: Text-based search engines (Entrez, DBGET /LinkDB). Sequence similarity based search engines (BLAST and FASTA). Motif-based search engines (ScanProsite and eMOTIF). Structure similarity based search engines (Combinatorial Extension, VAST and DALI). Proteomics tools: -ExPASy server, EMBOSS.	7	Knowledge on different bioinformatics search engines and their applications in retrieving data	1,2

IV	Pairwise sequence alignments: Sequence similarity, identity, and homology. Global and local alignment, BLAST and PSI-Blast, Application of Blast tool, Multiple sequence alignments and Application of multiple sequence	5	A good knowledge on sequence alignment and its application	1,2
V	alignment.  Computer assisted drug design- concept, methods and practical approaches, various computational methods applied to design the drugs, CADD software demonstration. Protein homology modelling	5	A brief knowledge on drug designing through computer as well as protein 3D modelling	1,2
Practical	Data retrieval from different biological database Sequence alignment through BLAST Protein homology modelling, Phylogenetic Analysis through MEGA software Demonstration of Drug designing.	30	Knowledge on different biological databases and sequence alignment tool.	1,2,3,4

1. Harisha S. Fundamental of Bioinformatics. 3rd edition. Dreamtech Press, 2019.

### **REFERENCE BOOKS:**

- **1**. Sharma T. R. Genome Analysis and Bioinformatics: A Practical Approach (English) (Paperback). 1st edition. Dreamtech Press; 2019.
- 2. Orengo C.A. et al. Bioinformatics: Genes, proteins and computers. 1st edition. Taylor & Francis, 2002.
- **3.** Kangueane P., Mathura V. Bioinformatics: A Concept-Based Introduction. 1st edition. Springer-Verlag New York Inc. 2009.

## **OTHER LEARNING RESOURCES:**

1. https://pubmed.ncbi.nlm.nih.gov/28830733/

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	A basic concept on Bioinformatics and its significance in the field of biological data analysis	1, 4, 9						
2	Knowledge on database management system and its application in Biology	1, 4, 5						
3	A good knowledge on sequence submission tools as well as biological search engines	1, 4, 5						
4	Knowledge on sequence alignment and analysis.	1, 4						
5	Learn the concept of computer aided drug designing	1, 3, 4						

SEMESTER – II														
Cours	e Title	Mush	room (	Cultivation	n: Techno-I	Profe	essio	nal						
Cours	e code	24MSMB1204R		credits: 2 hours: 60		L 0	T 0	P 4	S 0	R 0	O/F 0	<b>C</b> 2		
Pre-re	equisite	Nil	Total	Co-requi	site	U	U	-	N		U			
Progr			<u> </u>		e in Microb	iolos	ΣV							
Semes					year of the	`		nme	<u> </u>					
Ob	CO1 CO2 CO3 CO4	<ol> <li>To create awareness at 2. To strengthen the pequipped laboratory at 3. To know and explore Explain different classes Describe the reproduction Explain mushroom spawn Discuss the methods of creater awareness.</li> </ol>	about the romotice and office the cult of mush n and grand produce.	ne Mushroon of musices. tivation in mrooms. rowth of m	om among the hroom culting Assam ushrooms.	he pe	eople	<b>)</b> .		lishir	ng a w	/ell-		
	CO5	Apply the techniques for				snen	t							
Unit		Content	the utili	Contact	Lea	_		utco	me		K	ΚL		
No.				Hour										
I	(common mushroor mushroor poisonous mushroor	s mushroom, uses	on of	12	Understar characteri of mush distinction poisonous biological	istics room n be s va	s, ty _j ns, i twee rietic	ncluen e	udin dibl	g th e an	es e d	2,3,4		
II	growth an mushroor	of mushroom (reproducted not nutrition), Oyster and Bouns, Mushroom strue and maintenance		12	Grasp reproduct mushroor and Butt understan design an	tion, ns, f ton id	ocus mus thei	ing hroo	row on ( oms, stru	Dyste	of er d	2,3		
III		ry techniques for production spawn (seed)	on of	12	Understar fundamer mushroor	ıtal	_	inci	pply ples ducti	C	e 1,			
IV	Methods mushroor	for cultivation and harvesting	ng of	12	Understar technique cultivation	es n.	for	r	nusł	roor	n	2, 3		
V	Utilizatio	n of mushroom spent (wast	e).	12	Understar and ecc utilizing substrate.	onon sp		ber	nefit		of	2, 3, 4		

- T1. Mushroom Cultivation Technology by <u>Joy Sarkar, Krishnendu Acharya, Anirban</u> Roy. Publisher: Techno World
- T2. Handbook of Mushrooms 4th Edition by Bahl N, Oxford & Ibh Publishing

## **REFERENCE BOOKS:**

- R1. Mushroom Cultivation by Parveen Garg, Publisher: B.R. Publishing Corporation, ISBN: 9788193031421
- R2. Mushrooms: A Manual for Cultivation by S. Biswas, M. Datta, S. V. Ngachan, PHI Learning.

# **OTHER LEARNING RESOURCES:**

1. https://www.nhb.gov.in/pdf/Cultivation.pdf

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Explain different classes of mushrooms.	1				
2	Describe the reproduction and growth of mushrooms.	1				
3	Explain mushroom spawn production	1, 3, 4				
4	Discuss the methods of cultivation of mushroom	1, 3				
5	Apply the techniques for the utilization of mushrooms spent	1, 2, 3, 4				

	SEMESTER-II										
Cours	Course Title Generic Elective - Public Health And Hygiene										
Course code		24MSMB1205R	Total credits: 2	L	T	P	S	R	O/F	C	
			Total hours: 30	2	0	0	0	0	0	2	
Pre-requisite		Nil	Co-requisite				N	il			
	amme	Master of Science in Microbiology									
Semes		Fall/ I semester of first year of the Programme									
	ourse	1. To understand the concepts, significance and relevance of public health and hygiene.									
Обј	ectives	<ul><li>2. To understand the health hazards as associated with public health and hygiene.</li><li>3. To understand social health problems and health education in India.</li></ul>									
		Explain the concepts of public health, evaluate India's health systems and policies, and									
C	CO1	assess the impact of nutrition, environment, and mental health on public well-being									
	10.2		nental health hazar								
	O2	•	iene, waste manage	-	•		•				
C	203	Describe key hygi	ene concepts across	personal	, medi	ical, foo	od, and	d indust	trial settii	ngs.	
	04	Identify and understand the causes, prevention, and control measures of lifestyle-related									
			e and communicable								
C	O5	•	Analyse social health issues in India and evaluate the role of health education and								
Unit		programs in promoting dead diction and eco-friendly practices.  Content Contact Learning Outcome					me	KL			
No.		Content		Hour		Lea	ıınıng	Outco	iiic	KL	
I	INTRO	DUCTION		7		Knowle	dge	about	the	1, 2	
	Concept of Public Health Goals and				(	Concep	ts,	Goals,	and		
	-	ves of Public hea			Objectiv			Public			
		c health system in India and in the rest				Health a					
of wor		α ΓΗ ASPECTS			NRHU	and N	NUHM				
		ction to National	Health Policy -								
		al Rural Health Mis	-								
	Nationa	al Urban Health I									
		on and health, Envi									
		on, air, water polluti	5	1	//1	d			1 2 2		
II		ONMENT AN	ID HEALTH	5		Knowle Environ	-	al Pol	On	1, 2, 3	
		HAZARDS: Environmental degradation and Pollution: Sources, Impacts of wastes and treatment methods Environment & Health Relation				degrada			·		
						Food ad			•		
		nent - Concept, Step									
	Persona		hygiene, Health								
Water		ying habits and addictions Need of Purification Adulteration of Food									
		rable Changes in									
		e- waste, Solid w									
	disposa	1									
III		ENE CONCEPTS		5		Knowle	-		ygiene	1, 2	
		al Hygiene Medica				person			food		
IV	Hygiene Industrial Hygiene and industrial)  LIFE STYLE RELATED NON- 8 Theoretical and practical			ractical	1, 2, 3						
		IUNICABLE DISEA		U		knowled		and pr	on	1, 4, 3	
	COMIN	IONICABLE DISEA	JOEO .		ŀ	ZHOWIE	age		OH		

	Hypertension Coronary Heart Diseases		communicable and non-	
	Stroke, Diabetes Mellitus Obesity		communicable diseases	
	COMMUNICABLE DISEASES AND			
	THEIR CONTROL MEASURES:			
	Air Borne Disease: Tuberculosis, Influenza			
	Food and water Borne Disease: Amoebiasis,			
	Jaundice, Vector Borne Disease: Malaria,			
	Dengue Contact Disease: Venereal disease			
	and AIDS			
V	SOCIAL HEALTH PROBLEMS AND	5	Knowledge on Indian	1, 2, 3
	HEALTH EDUCATION IN INDIA:		Health Education and	
	Smoking, Alcoholism, Drug Dependence and		Social health problems	
	Their Dead diction. Eco-Friendly			
	Environmental Practices, Effects of drug			
	abuse, WHO programmes Government and			
	voluntary Organizations - vaccination and			
	awareness programme, First Aid			

- T1. Introduction to Public Health, Raymond L. Goldsteen, Karen Goldsteen, David G. Graham, 2011, Springer publishing company
- T2. Introduction to Community Health Nursing, Kasturi Sundar Rao, 4th edition, Bi Publications Pvt Ltd
- T3. Concepts of Epidemiology, Raj S Bhopal, 2002, Oxford University press
- T4. A Treatise n Hygiene and Public Health, Birendra Nath Ghosh, 9th edition, Calcutta Scientific Publishing Co

### **REFERENCE BOOKS:**

- R1. Park and Park, 1995: Text book of preventive and social medicine Banarsidas Bhanot Publ. jodhpur-India
- R2. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India
- R3. Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation -Part I- IV
- R4. Murray, C. J. L. and A.D. Lopez. (1996). The Global Burden Of Disease. World Health Organization.
- R5. Park, J.E. and Park, K. Textbook of Community Health for Nurses.

### **OTHER LEARNING RESOURCES:**

1. https://www.cdcfoundation.org/what-public-health

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Explain the concepts of public health, evaluate India's health systems and policies, and assess the impact of nutrition, environment, and mental health on public well-being	1, 2, 4, 7				
2	Analyse environmental health hazards, assess pollution impacts, and understand the importance of hygiene, waste management, and food safety.	1, 2, 4, 7, 8				
3	Describe key hygiene concepts across personal, medical, food, and industrial settings.	1, 5, 7				
4	Identify and understand the causes, prevention, and control measures of lifestyle-related non-communicable and communicable diseases.	1, 2, 4, 5, 7				
5	Analyse social health issues in India and evaluate the role of health education and programs in promoting dead diction and eco-friendly practices.	1, 2, 4, 7				

	SEMESTER-II										
Cours	Course Title Research Methodology and Statistical Analysis										
Course code		24UMRM1201R	Total Credits: 2		L	T	P	S	R	O/F	
	• • •	3.701	Total Hours:15T+60S		1	0	0	4	0	0	2
	equisite	Nil	-								
	ramme	Master of Science in Microbiology									
Semes	Semester Spring/II semester of First year of the Programme										
Course Objectives		<ol> <li>The course aims to enhance the students' a broad understanding of research methodology, includingtheoryofscienceandqualitativeandquantitativemethodsinresearch.</li> <li>The course seeks to enhance the students' skills for developing critical thinking through research literature review in different domain. Consequently, it aims to develop skills for preparation of a research proposal for a master' thesis project/ Mini research.</li> <li>To develop Students competency in planning, conducting, evaluating and presenting a research project.</li> </ol>									
(	CO1	Students will have basic	knowledge of Rese	arch meth	ods.						
	CO2	Students will gain the k	nowledge of Research	ch Method	ology	7.					
C	CO3	Students will be able to gain the Skill questionnaire development.									
(	CO4	Students will be able to	Students will be able to acquire the knowledge of basic Report/dissertation Procedure.								
C	CO5	Knowledge on different	IPR rights								
Unit		Content Contact Learning KL								KL	
No	Pagagra	h Mathadalagy An Intra	duation magning	Hour 2	Vno	wled	utco	ome	0	n	1,2
I Research Methodology- An Introduction- m and objectives of research, motivation in restypes and significance of research, criteria or research. Defining the Research Prodefinition of research problem, necess defining research problem			ation in research, , criteria of good arch Problems-		function meal objection	lame cepts hodo uding ning ective	-nta of logy g	res	earc th an	h e	-,-
П	II Research Design- meaning and need of a design, features of a good design, or research designs, Sampling Design- steps in sampling Sample Size determination, criteria for sel sampling design, different types of s design, Experimental Design, Principles of of Experiment, One – way ANOVA, Tw ANOVA, CRD, RBD, LSD, 22, 23 F. Design		design, different ampling design, ita for selecting a es of sampling nciples of Design DVA, Two- Way	4	Able and func prin desi mea	lame ciple gn, i ning	o ur appl ntal es of nclu	y resolidin	th earc g th an	e h e d	1,2
Ш	Types of data contration measure (SD), U for interdevelop	of data, sources of data confidencies, Nominal, ording—Attitude scale comment, rating scales, semulates are seen of scale in statistical and erviews preparation and ment of survey instrument for the questionnaire	al, interval and onstruction and antic differential alysis, Schedules standardization,	3	on data varie tool	ous	rent nd sour for	typ ide rces	es c	of y d	1,2

IV	Planning and organizing research report, Format of research report, Different steps of writing report, lay out of the research report, How to organize thesis/Dissertation, mechanics of writing research report, standard methods of quoting- presenting the result, written and oral reports, Uses of abstract, format of research report, presentation of statistics -	3	Able to organize and write a comprehensive research report	1,2
	tabular and graphic references and uses of references, Bibliography and presentation of bibliography			
V	Intellectual property right (IPR), Introduction and the need for IPR, IPR in India and worldwide, Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications, Patentable and non-patentable, patenting life, Filing of a patent application, The different layers of the international patent system, Case studies on Basmati rice, Turmeric, and Neem patents	3	Knowledge on importance of Intellectual Property Rights (IPR) both in India and globally	1,2
Practical	Laboratory using R Software:  1 Analysis of One way ANOVA;  2 Analysis of Two way ANOVA;  3 Analysis of CRD  4 Analysis of RBD  5 Analysis of 22 and 23 Factorial Experiment  6 Simulation-I using R (Bernoulli, Binomial, Poisson and Geometric distribution.).  7 Simulation-II using R (Exponential and Normal distribution).  8 Simple random Sampling  9 Stratified Random Sampling	60	Knowledge on various statistical experiments and simulations using R	1,2,3,4

T1: Methods in Biostatistics by K S Negi, ISBN: 9789374735053, 4th Edition, Year: 2023, AITBS Publishers, INDIA

## **REFERENCE BOOKS:**

R1. Johnson & Christensen. (2004). Educational Research: Quantitative, qualitative and mixed approaches, 2nd Ed. Boston: Allyn & Bacon.

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Students will have basic knowledge of Research methods.	2, 4, 9				
2	Students will gain the knowledge of Research Methodology.	2, 4, 9				
3	Students will be able to gain the Skill questionnaire development.	2, 4, 5				
4	Students will be able to acquire the knowledge of basic Report/dissertation Procedure.	4, 5				
5	Knowledge on different IPR rights	6, 7				

SEMESTER – II									
Course Title	Title MINI RESEARCH 2 (RESEARCH GAP ANALYSIS)								
Course code	24MSMB1206R	R Total credits: 3 Total hours: 192 (S+R)  L T P S R 0 0 0 4 12						O/F 0	C 3
Pre-requisite	Nil	Co-requisite	Nil						
Programmes	Master of Science in Biotechnology								
Semester	Fall/I Semester of First Year of the Programme								
Course Objectives	applications in ide  2. To develop the a where further rese	nts to formulate research qu	isting	g lite	eratu	re an	d ide	ntify ar	eas
CO1	Analyze existing litera	ature							
CO2	Identify research gap								
CO3	Formulate research qu	Formulate research questions							
CO4	Formulate research objectives								
CO5	Prepare research syno	psis							

CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome			
1	Analyse existing literature	1, 2, 4			
2	Identify research gap	1, 2, 4			
3	Formulate research questions	1, 2, 4, 9			
4	Formulate research objectives	1, 2, 4, 9			
5	Prepare research synopsis	1, 2, 4			

		SEMESTER-II								
<b>Course Title</b>	UNIVERSAL	HUMAN VALUES (UHV) +	PRO	FESS	ION	AL l	ETH	ICS		
Course Code	24UUHV1201R	Total Credits: 2	L	T	P	S	R	O/F	C	
		Total Hours:15T+30P	1	0	2	NI:1	0	0	2	
Pre-Requisite	Nil	Co-requisite  Magtan of Science in Mi	ana <b>hi</b> al	lo ovi		Nil				
Programme	Master of Science in Microbiology									
Semester		Winter/II semester of First year of the Programme								
Course Objectives	and 'SKILLS' to aspirations of all  2. To facilitate the cand profession a understanding of perspective form value-based livin  3. To highlight plate ethical human can mutually enriching	and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings  2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way								
CO1		The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.								
CO2	It is free from any do	ogma or value prescriptions.								
CO3	It is a process of self	-investigation and self-explora	ation, a	nd no	ot of §	givin	g ser	mons.		
CO4	facilitated to verify subsequent Experien	Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.								
CO5	_	exploration takes the form of gin with, and then to continution.		-						
Unit No.		Content								
I	<ul> <li>Self-Exploration—v Experiential Valida</li> <li>Continuous Happin</li> <li>Right understanding fulfilment of aspira</li> <li>Understanding Hap scenario</li> </ul>	<ul> <li>Understanding the need, basic guidelines, content and process for Value Education</li> <li>Self-Exploration—what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration</li> <li>Continuous Happiness and Prosperity- A look at basic Human Aspirations</li> <li>Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority</li> <li>Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario</li> <li>Method to fulfil the above human aspirations: understanding and living in harmony</li> </ul>								
II	<ul> <li>Understanding human being as a co-existence of the sentient 'I' and the material 'Body'</li> <li>Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha</li> <li>Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)</li> <li>Understanding the characteristics and activities of 'I' and harmony in 'I'</li> <li>Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail</li> <li>Programs to ensure Sanyam and Swasthya-Practice Exercises and Case Studies will be taken up in Practice Sessions.</li> </ul>									

# III Understanding Harmony in the family – the basic unit of human interaction Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family!-Practice Exercises and Case Studies will be taken up in Practice Sessions. IV Understanding the harmony in the Nature Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and self-regulation in nature Understanding Existence as Co-existence (Sah-astitva) of mutually interacting unitsin all-pervasive space Holistic perception of harmony at all levels of existence-Practice Exercises and Case Studies will be taken up in Practice Sessions. V Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers At the level of society: as mutually enriching institutions and organizations **Guidelines and** UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value **Content for** Education **Practice** PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your Sessions goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyse them. Expected outcome: the students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course. PS 2: Now-a-days, there is a lot of voice about many techno-genic maladies such as

energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. – all these seem to be manmade problems threatening the survival of life on Earth – What is the root cause of these maladies & what is the way out in your opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc – what do you think, is the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

Expected outcome: the students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living. Any solution brought out through fear, temptation or dogma will not be sustainable.

#### PS 3:

- 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of
  - i) What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect?
  - ii) What is Naturally Acceptable to you to nurture or to exploit others? Is your living the same as your natural acceptance or different?
- 2. Out of the three basic requirements for fulfilment of your aspirations- right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

#### Expected outcome:

- The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
- 2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- 3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

PS 4: List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.

Expected outcome: the students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body

assuming that it will meet the needs of 'I' too.

PS 5:

1.

- a. Observe that any physical facility you use, follows the given sequence with time:

  Necessary & tasteful→ unnecessary & tasteful → unnecessary & tasteless

  →intolerable
- b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!
- 2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.
- 3. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

#### Expected outcome:

- 1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.
- 2. the students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body.
- 3. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

#### PS 6:

- 1. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilisation of the body.
- 2. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases.

Expected outcome: The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

- UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
- PS 7: Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:
  - 1a. Do I want to make myself happy?
  - 2a. Do I want to make the other happy?
  - 3a. Does the other want to make him happy?
  - 4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

- 1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy?
- 3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy?

What is the answer?

#### Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention& competence as well as the others' intention & competence.

Expected outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

#### **PS** 8:

- 1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation.
- 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected outcome: The students are able to see that respect is right evaluation, and only right evaluation leads to fulfilment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

#### PS 9:

- 1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
- 2. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children

Expected outcome: The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

PS 10: List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders.

Expected outcome: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and

right utilization) in the nature.

#### PS 11:

- 1. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in the existence.
- 2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are able to make out how these courses can be made appropriate and holistic.

- UNIT 5: Implications of the above Holistic Understanding of Harmony at all Levels of Existence
- PS 12: Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected outcome: The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

#### PS 13:

- 1. Suggest ways in which you can use your knowledge of Technology/ Engineering/ Management for universal human order, from your family to the world family.
- 2. Suggest one format of humanistic constitution at the level of nation from your side. Expected outcome: The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.
- PS 14: The course is going to be over now. Evaluate your state before and after the course in terms of
  - a. Thought b. Behaviour c. Workd. Realization

Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

Expected outcome: The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for a happy and prosperous society.

#### **TEXT BOOKS:**

T1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

#### **REFERENCE:**

- R1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
- R2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
- R3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

#### **OTHER LEARNING RESOURCES:**

- 1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
- 2. Story of Stuff, http://www.storyofstuff.com
- 3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
- 4. Charlie Chaplin, Modern Times, United Artists, USA
- 5. IIT Delhi, Modern Technology the Untold Story

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.	1, 2, 3, 4, 7				
2	It is free from any dogma or value prescriptions.	1, 3, 4				
3	It is a process of self-investigation and self-exploration, and not of giving sermons.	1, 2, 3				
4	Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.	1, 3, 5				
5	This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.	3, 8				

		S	SEMES	TER-II								
Course	e Title	COMMUNICATION	MAST	ERY (Com	municati	ve Eı	nglisł	1 & S	oft Sl	kills)		
Course	e Code	24UMPD1201R		Credits: 2			P	S	R	O/F	C	
			Total	Hours: 60	P 0	0	4	0	0	0	2	
Pre- Requis	sita	Effective English	C	Co-requisite Nil								
Progra		Ma	aster of	Science in	Microbio	logy						
Semes		Spring/II s				00	gram	me				
	urse ctives	<ol> <li>To familiarize students wit prepositions.</li> <li>To enhance the writing skil</li> <li>To convey meaning by communication.</li> <li>Productivity and performant</li> </ol>	lls in dif	ferent areas	s including estituting	g CV for,	and o	cover contr	letter adicti	writin	ıg. erbal	
C	01	Explain prepositions, tag ques						<u> </u>				
C	02	Discuss and analyse different										
C	03	Explain effective paragraphs,	precis, a	and professi	ional docu	ment	S.					
C	04	Describe SWOT analysis, goa	l setting	g, and perso	nal hygier	ne pri	ncipl	es.				
C	05	Illustrate non-verbal communi	ication a	and body la	nguage co	ncep	ts.					
Unit		Content		Contact	Lea	rnin	g Out	com	e	K	L	
No.	Gram			Hour 8	Identify					1	,2	
	<ul><li>Use</li><li>Tag</li><li>Idio</li><li>Sim</li></ul>	of Prepositions g questions oms, Phrases and Clauses aple, complex, compoutences	und	ŭ	refine accuracy commun	y	gra		atical in		<b>,-</b>	
II	• Act			6	Learn we each ve suit the	oice	effec	ctivel	y to	1	,2	
III	<ul> <li>The Basics of Writing; avoid ambiguity and vagueness</li> <li>Paragraph Writing</li> <li>Precis Writing</li> <li>Letter Writing, Resume, CV and Cover Letter</li> </ul>					Develop clarity in writing by eliminating ambiguity and vague expressions which helps to focus on precise and concise communication.						
IV	<ul><li>SW</li><li>Self</li></ul>	Ianagement Skills: OT Analysis f-Regulation Goal Setting, Pers giene	onal	15	Learn to strength opportune for per self-imp	s, nities sona	we s, an l gre	eakne d th owth	esses, reats	1	,2	

V	Non- Verbal Communication-	25	Identify and interpret different	1,2
	Sciences of Body Language:		forms of body language in	
	What is Non-Verbal		personal and professional settings.	
	Communication & Body			
	Language,			
	• Elements of Communication,			
	• Types of Body Language,			
	Importance and Impact of Body			
	Language,			
	Types of Communication through			
	Body Language,			
	• Introduction to Haptic,			
	Introduction to Kinesics			
	• Introduction to Proxemics,			
	Body Language Do's and Don'ts,			
	• Doubt Clearing Session.			
	<b>Group Discussion (Theory):</b>			
	• Importance,			
	• Planning, Elements, and Skills			
	assessed;			
	• Effectively disagreeing,			
	Initiating, Summarizing and			
	Attaining the Objective			

- T1. Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing and Speaking, Zephyros Press.
- T2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

#### **REFERENCE BOOKS:**

- R1. Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation and Social Speaking, Ian Tuhovsky, 2019
- R2. A Textbook for AECC English Communication: Interface, Dr. Kironmoy Chetia and Pranami Bania Breez Mohan Hazarika, January 2019.

# OTHER LEARNING RESOURCES:

- 1. https://youtu.be/x60GHpQ8gJk
- 2. https://youtu.be/Ke_oSN-BCaY
- 3. https://youtu.be/TDPDtrLxT-c
- 4. https://www.classcentral.com/report/toefl-preparation/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Explain prepositions, tag questions, and idioms correctly.	5					
2	Discuss and analyse different sentence types and voices.	2, 5					
3	Explain effective paragraphs, precis, and professional documents.	3, 5					
4	Describe SWOT analysis, goal setting, and personal hygiene principles.	5					
5	Illustrate non-verbal communication and body language concepts.	5					

SEMESTER-III												
Cou	rse Title	Techno-P	rofessional Skills	s II (Bio fert	tilizer pro	duction)						
Cou	rse Code	24MSMB2101R	Total Credits: Total Hours: 6			T P S 0 4 0	<b>R</b> 0	O/F 0	<b>C</b> 2			
Pre-	Requisite	General Microbiology, Biochemistry	Co-Requ	isite	NA							
Prog	gramme		Master of Scien	ce in Micro	biology							
Sem	Semester Fall/ 3 rd Semester of 2 nd year of the Programme											
	Course bjectives	<ul><li>2. Formulate, produ</li><li>3. To provide k</li></ul>	<ol> <li>Formulate, produce and apply Bio fertilizers in a pilot scale</li> <li>To provide knowledge on the various methods of bio fertilizer production, such as liquid culture, solid-state fermentation, and carrier-</li> </ol>									
	CO1	Explain the Importance	of bio fertilizers	in plant deve	elopment.							
	CO2	Describe mass cultivati	on and inoculation	n.								
	CO3	Explain the importance	of Azolla as a bio	fertilizers.								
	CO4	Describe the importance	e of phosphate in	bio fertilizer	·s.							
	CO5	Apply the knowledge of	on the use of Fung	<u>*</u>	rhiza.							
Unit		Content Contact Learning Outcome				ome	1	KL				
No I	Biofertilize	rs - Introduction, sco	ne A general	Hour 10	Importa	nce of	bi	0 1	1,2			
	account of Cyanobacte	plant growth promoters a erial Biofertilizer: Algal of cyanobacterial bioferti	and regulators – ization – mass	10	fertilizer develop	rs in	plan		.,2			
II	identification method Mechanism	xing Bacteria: Isolation, con, mass cultivation a of Rhizobium and of nitrogen fixation ( - Biochemistry and modulation.	Azospirillum.	15	Knowled mass cu inoculat	ıltivation	abou an		1,2			
III	cultivation	Structure and Morpho method and Application importance of Azolla.	••	10	Importa	nce of Az	zolla	. 1	1,2			
IV	inoculation Biochemistr mobilization		cultivation and Phosphobacteria. ubilization and lum production	d phosphate in bio fertilizers				1,2				
V	scope. A Arbuscular method of	l fungi as biofertilizers general account of Eo mycorrhizae (AM). inoculation of Arbuscul ume - AM interactions	cto, Endo and Isolation and	and Mycorrhiza and				1	1,2			

T1: A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi. Ann Larkin Hansen, 2010.

## **REFERENCE BOOKS:**

- R1. Kannaiyan, S. 2002 Biotechnology of Bio fertilizers. Narosa publishing house, New Delhi. Dubey, R.C. 2001.
- R2. Dubey, R. C. 2008. A Textbook of Biotechnology. S. Chand & Co., New Delhi.

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the Importance of bio fertilizers in plant development.	1, 2, 9					
2	Describe mass cultivation and inoculation.	1, 2, 3					
3	Explain the importance of Azolla as a bio fertilizers.	1, 2, 9					
4	Describe the importance of phosphate in bio fertilizers.	1, 2, 9					
5	Apply the knowledge on the use of Fungi and Mycorrhiza.	1,9					

	SEMESTER-III												
Cours	se Title	Gener	ic Elective -	Public Hea	lth And	Hy	gier	1e					
G	<b>C</b> 1	A41 (C) (DA10AD	<b>Total Cred</b>	its: 2		L	Т	P	S	R	O/F	С	
Cours	se Code	24MSMB2102R	<b>Total Hour</b>	es: 30	-	2	0	0	0	0	0	2	
Pre-re	equisite	Nil	Co	-requisite			ı		Ni	1	I		
	amme	I	Master of Sc		icrobiolo	gy							
Semes			semester of				amn	ne					
<b>Course</b> 1. To understand the concepts, significance and relevance of public health and hygi						hvgier	ne.						
	jectives	2. To understand the health hazards as associated with public health and hygiene.											
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Explain the concepts of public health, evaluate India's health systems and policies, and											
	C <b>O</b> 1												
			assess the impact of nutrition, environment, and mental health on public well-being  Analyse environmental health hazards, assess pollution impacts, and understand the										
	CO ₂	importance of hygiene, was		_		_	ucts	, 411	u ui	idei	Staria	tiic	
	CO3							داد ماد		.1	44:		
	.03	Describe key hygiene conc											
	CO4	Identify and understand the	•		d control	me	easui	es c	of lif	esty	le-rela	ited	
<u> </u>		non-communicable and con											
	CO5	Analyse social health iss						heal	th e	duc	ation a	and	
	1	programs in promoting dea	d diction and										
Unit		Content		Contact	Learning Outcome				Learning Outcome			K	L
No.	n imp o p	Y COTT O Y		Hour									
I		OUCTION	7	Knowl	_		abo		the	1,	2		
	_	of Public Health Goals and	-		Concepts, Goals, and Objectives of Public								
					· ·					olic			
	•	India and in the rest of wor					d Hy	-					
		H ASPECTS	Dalian		NRHU and NUHM								
		ion to National Health	~										
	National	Rural Health Mission (N Urban Health Mission	*										
		and health, Environmen	,										
		n, air, water pollution, Menta											
II		NMENT AND HEALTH I		5	Knowle	da				on	1 2	2, 3	
**		nental degradation and	Pollution:	3	Enviror	_		P	ollut			<b>-</b> , <i>J</i>	
		Impacts of wastes and			degrada								
		Environment & Health			Food ac				0110	una			
		ent - Concept, Steps and			1 000 00								
		and mental hygiene, Health											
			of Water										
	Purificati	on Adulteration of Food	Undesirable										
	Changes	in Air, Radiation effects,	, e- waste,										
	_	ste and Excreta disposal											
III	HYGIEN	IE CONCEPTS		5 Knowledge on hygic				iene	1,	2			
Personal		Hygiene Medical Hyg	iene Food		(person	al,	Me	dica	al, f	ood			
	Hygiene	Industrial Hygiene		and industrial)									
IV	LIFE ST	E STYLE RELATED NON-COMMUNI- 8 Theoretical and practical				1, 2	2, 3						
		DISEASES			knowle	dge	•			on			
	Hyperten	sion Coronary Heart Disease	es Stroke		commu	nic	able			and			
	Diabetes	Mellitus Obesity COMMU	JNICABLE		non-cor	nm	unic	able	2				
	DISEAS		CONTROL		diseases	S							
	MEASU	RES:											
	Air Born	ne Disease: Tuberculosis	, Influenza										

	Food and water Borne Disease: Amoebiasis,			
	Jaundice			
	Vector Borne Disease : Malaria, Dengue			
	Contact Disease: Venereal disease and AIDS			
V	SOCIAL HEALTH PROBLEMS AND	5	Knowledge on Indian	1, 2, 3
	HEALTHEDUCATION IN INDIA:		Health Education and	
	Smoking, Alcoholism, Drug Dependence and		Social health problems	
	Their Dead diction. Eco-Friendly Environmental			
	Practices, Effects of drug abuse, WHO			
	programmes Government and voluntary			
	Organizations – vaccination and awareness			
	programme, First Aid			

- T1. Introduction to Public Health, Raymond L. Goldsteen, Karen Goldsteen, David G. Graham, 2011, Springer publishing company
- T2. Introduction to Community Health Nursing, Kasturi Sundar Rao, 4th edition, Bi Publications Pvt Ltd
- T3. Concepts of Epidemiology, Raj S Bhopal, 2002, Oxford University press
- T4. A Treatise n Hygiene And Public Health, Birendra Nath Ghosh, 9th edition, Calcutta Scientific Publishing Co

#### **REFERENCE BOOKS:**

- R1.Park and Park, 1995: Text book of preventive and social medicine Banarsidas Bhanot Publ. jodhpur-India
- R2. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India
- R3.Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation -Part I- IV
- R4.Murray, C. J. L. and A.D. Lopez. (1996), The Global Burden of Disease. World Health Organization.
- R5.Park, J.E. and Park, K. Textbook of Community Health for Nurses.

#### **OTHER LEARNING RESOURCES:**

1. https://www.cdcfoundation.org/what-public-health

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the concepts of public health, evaluate India's health systems and policies, and assess the impact of nutrition, environment, and mental health on public well-being	1, 2, 4, 7					
2	Analyse environmental health hazards, assess pollution impacts, and understand the importance of hygiene, waste management, and food safety.	1, 2, 4, 7, 8					
3	Describe key hygiene concepts across personal, medical, food, and industrial settings.	1, 5, 7					
4	Identify and understand the causes, prevention, and control measures of lifestyle-related non-communicable and communicable diseases.	1, 2, 4, 5, 7					
5	Analyse social health issues in India and evaluate the role of health education and programs in promoting dead diction and eco-friendly practices.	1, 2, 4, 7					

		S	SEME	STER-III								
Course	Title			Resear	ch Ethics							
Course	Code	24UMRE2101R		Total Cred		L	T	P	S	R	O/F	C
				Total Hou		1	0	0	0	0	0	1
Pre-Rec	quisite	NA		Co-Requi	isite				N/	4		
Prograi	nme		Maste	er of Scienc	e in Micro	biol	ogy					
Semeste	er	Fall/	3rd Se	emester of 2	2 nd year of	the	prog	gram				
Course Objectives		research practices.  2. To address issues and the importance falsification, and pl  3. To develop critical	<ol> <li>To address issues related to authorship, publication ethics, peer review, and the importance of avoiding research misconduct like data fabrication, falsification, and plagiarism.</li> <li>To develop critical thinking and ethical decision-making skills to navigate complex research scenarios, balancing scientific progress with respect for</li> </ol>									
(	CO1	Describe and apply rese	arch e	thics theorie	es and meth	ods.						
(	CO2	Explain research ethics	issues	such as resp	ponsibility,	vett	ing,	and 1	nisc	ondı	ıct.	
	CO3	Illustrate arguments and results in ethical research inquiries.										
CO4 Identify and apply proce				for samplin	ıg, data coll	ecti	on, a	nd re	port	ing.		
(	CO5	Apply ethical principles	to res	earch desig	n and evalu	atio	n					
Unit		Content		Contact	Lear	nin	g Oı	ıtcon	ne		K	L
No.				Hours								
I	other; an Ethics: d nature of reactions. regulation candor, co ownership interest; Non-Hum	on to the course and introduction to moral the efinition, moral philoso	eory.  ophy, and elf —  nesty, Data ets of and	3	Understa ethical protheories contexts, issues re- ethics.	rinci cri	ples in tical	and re ly ev	mor seard	al ch ite	1,	2
П	Ethics w research. research in Scientific Fabrication Redundan overlappin slicing.	misconducts: Falsifica on, and Plagiarism (FFP). t publications: duplicate	and ation,	2	Understa ethical p scientific demonstr honesty integrity, prevent miscondu	rinc ate a r	iples and	inteli re gnize	ondud lectu seard	to et, al eh	1,	2

III	PUBLICATION ETHICS-	3	Understand the importance	1,2
	Publication ethics: definition, introduction and importance.  Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals.		of publication ethics, recognize best practices and standards	
IV	OPEN ACCESS PUBLISHING  Open access publications and initiatives. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies. Software tool to identify predatory publications developed by SPPU. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer	3	Understand the concept and significance of open access publishing	1,2
	Journal Suggester, etc.			
V	PUBLICATION MISCONDUCT Group Discussions; Subject specific ethical issues, FFP, authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad. Software tools; Use of plagiarism software like Turnitin, Urkund and other open source software tools.  DATABASES AND RESEARCH METRICS— Databases: Indexing databases. Citation databases: Web of Science, Scopus, etc. Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, and Cite Score. Metrics: h-index, g index, I 10 index, altmetrics.	4	Gain proficiency in navigating indexing and citation databases	1,2

- T1. Bird, A (2006). Philosophy of Science Routledge.
- T2. MacIntyre, Alasdair (1967) A Short History of Ethics London.
- T3. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019)

## **REFERENCE BOOKS:**

- R1. National Academy of Science, National Academy of Engineering and Institute of Medicine (2009). On Being a Scientist: A Guide of Responsible Conduct in Research: Third Edition, National academics Press.
- R2. George R, (2011). Sociological Theory, Rawat Publication, New Delhi, India.
- R3. George R, (2019). Post Modern Social Theory, Rawat Publication, New Delhi, India.

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Describe and apply research ethics theories and methods.	6					
2	Explain research ethics issues such as responsibility, vetting, and misconduct.	6					
3	Illustrate arguments and results in ethical research inquiries.	5, 6					
4	Identify and apply procedures for sampling, data collection, and reporting.	2, 3, 4					
5	Apply ethical principles to research design and evaluation	4, 9					

	SEMESTER – III										
Course Title	MIN	I RESEARCH (SURVEY/EX	PER	IME	NTS-	R3)					
Course Code	24MSMB2103R	Total Credits: 2	L	T	P	S	R	O/F	C		
Course Code	24MSMD2103K	Total Hours: 120 (P+S)	0 0 6 4 0 0 4								
<b>Pre-requisite</b>	Nil	Co-requisite				Nil					
Programmes		Master of Science in Bioto	echno	ology							
Semester	Spri	ng/II Semester of First Year	of the	Prog	gram	me					
Course Objectives	formulation and s  2. To gain hands-on test hypotheses.  3. Develop skills to	rinciples of designing effect ampling techniques. a experience in designing and co o present research findings cl risual aids like posters and slide	ondu early	cting	resea	arch (	expe	riments	s to		
CO1	Formulate research	methodology									
CO2	Prepare research too	ol(s)									
CO3	Apply the knowledg	ge of sampling methods in samp	le co	llecti	on.						
CO4	Design experiment	using scientific method									
CO5	Investigate the resea	arch Problem									

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Formulate research methodology	1, 2, 4, 6, 7							
2	Prepare research tool(s)	1, 3, 4							
3	Apply the knowledge of sampling methods in sample collection.	1, 2, 3, 4							
4	Design experiment using scientific method	1, 2, 3, 4, 6							
5	Investigate the research Problem	1, 2, 3, 4, 7, 9							

		S	EMESTER-I	III								
Cours	e Title		CORPORAT	E COMP	ETEN(	CY						
Cours	e Code	24UMPD2101R	Total Credit		L	T	P	S	R	O/F	C	
			Total Hours		0	0	4	0	0	0	2	
	equisite	<b>Communication Mastery</b>	Co-Req					NA	<u> </u>			
	ammes		S taster of Scie									
Semes	ter		Semester of 2						•			
		1. To acquaint students w					_				41	
C	ourse	2. To acquire the speaking listeners.	ng skin msut	ict, iiiituei	nce, eng	gage	, eau	cate,	or a	ppease	tne	
	ectives	3. To increase proficiency, present ability and quality of resume and provide										
Obj	ccuves	guidance for self- promotion and self-evaluation in social media.										
4. To prepare and train the students for the campus drives & walkin							nterv	iews.				
	CO1	Able to speak with greater						-0 -	'			
	CO3	Discuss the positive impact						olvin	g ski	lls.		
	CO3	Illustrate with all the nece			•							
C	CO4	Discuss the highlights and assess themselves in social media.										
		Explain the impart in them techniques to solve critical problems in an interview,										
C	CO5	develop strategies to crack	interviews, in	mprove th	eir com	mun	icatio	on sk	cills,	boost t	heir	
		confidence										
Unit		Content		Contact	L	earn	ing (	Outc	ome		KL	
No				Hour								
I		ntion Skills:		4	Understand the importance						1,2	
		tial characteristics of a good	_		of pr							
	• Prepa	ration of a good presentation			personal and professional contexts. It also helps to							
									_			
					recogr make				entati			
					effecti			•				
					engage					-		
II	Public S	kills:		20	Learn					and	1,2	
		of Public Speaking,			practio	•	•	ategi		to	_,_	
		erstanding and Overcomin	g Fear of		manag		and	_	redu	ice		
		ic Speaking,	8		speaki	ng a	nxiet	y				
		fidence and Control,										
		iology and Stress - Control/	Process,									
	-	for Presentations and Public										
	_	for Using Visual Aids in Pre										
	• Proc											
	Prese	entations,										
	• Deli	vering Presentations Success:	fully,									
	• Doul	bt Clearing and Summary	of Main									
	Poin	ts										

III	Practical session on Resume, Curriculum	10	Gain expertise in drafting	1,2
	Vitae, Writing cover letter & LinkedIn Profile:	10	impactful cover letters and	1,2
	Preparation, submission & screening of		learn to create tailored	
	Resume.		resumes that highlight	
	Practical session on cover letter screening		relevant skills and	
	session		achievements.	
	Creating a profile on LinkedIn			
	How to utilize it			
	Leadership & Management Skills :			
	Concepts of Leadership,			
	Leadership Styles,			
	Manager VS Leader,			
	How to be an Effective Leader,			
	Mock/ Practice Session,			
	Doubt Clearing Session.			
IV	Research Paper – Writing Skills:	20	Understand the	1,2
	How to write a research paper		fundamental principles and	
	Key point in Research Work		importance of leadership in	
	Interview Skills & Dress code Ethics:		various contexts.	
	Types of the interview- telephonic, virtual &			
	face to face			
	Online interview, personal interview,			
	Panel interview,			
	Group interview,			
	JAM session,			
	Types of interview questions-			
	traditional/common interview questions,			
	Case interview questions,			
	General Strategies for answering questions,			
	Marketing your skills and experiences,			
	Preparation before the interview,			
	How to dress up for an interview,			
	How to maintain eye contact and positive			
	body language,			
	How to be presentable,			
	Interview dos and don'ts,			
	Introduction to Dress Code Ethics,			
	Purpose and Importance			
	How to Make "FIRST IMPRESSION"			
	What to Wear During Interviews or Any			
	Other Formal Meetings – Male & Female			
V	Mock Interview:	6	Identify critical aspects of	1,2
	Practical Mock Interview,		conducting research,	
	• Feedback- Receiving Feedback,		including hypothesis	
	Giving Feedback,		formation and data	
	Advantages of Effective Feedback,		analysis.	
	How to deal with negative feedback.			

- T1. Barrett, Grant.2016.Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.
- T2. McDowell, Gayle Laakmann. 2008. Cracking the Coding Interview (Indian Edition).

#### **REFERENCE BOOKS:**

R1. Garg. Manoj Kr. (2018) English Communication: Theory and Practice

# **OTHER LEARNING RESOURCES:**

1. https://brightlinkprep.com/10-best-toefl-prep-books/

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Able to speak with greater control and charisma in front of others.	5
2	Discuss the positive impact in their thought process and problem-solving skills.	2
3	Illustrate with all the necessary tools and skill sets to prepare professional resume.	5
4	Discuss the highlights and assess themselves in social media.	5
5	Explain the impart in them techniques to solve critical problems in an interview, develop strategies to crack interviews, improve their communication skills, boost their confidence	5, 6, 8

			SEMES	STER-III								
Course	Гitle	PERSON	NAL FINA	NCIAL PLAN	NIN	IG	1	1		1		
Course	Code	24UUFL2102R	Total Cred Total Hou		<b>L</b> 0	T 0	P 2	S 0	R 0	O/F 0	<b>C</b>	
Pre- Rec	quisite	Introduction to Financial Budgeting And Planning	Co-R	lequisite				Nil				
Progran	nmes		r of Science	e in Microbiol	ogy							
Semeste	r	Fall/ 3 rd Sem	nester of 2 nd	d year of the P	rogr	amn	ne					
	urse ectives	<ol> <li>The course would offer an inclusive approach to understand the relevant concepts of money, borrowing, lending, taxes and their application to financial planning.</li> <li>Assess the personal financial planning process, the life cycle of financial plans, and methods of goal achievement.</li> <li>Formulate a budget, record-keeping system, and tax planning strategy based on current financial goals.</li> </ol>										
CO	)1	Explain the cash management	and buying	plan for homes	or a	uton	nobil	les.				
CO	)2	Discuss a diversified investment	nt portfolio	for different ob	jecti	ives.						
CO	)3	Compare mutual funds, ETFs,	and real est	ate investment	optio	ons.						
CO	)4	Develop a financial plan for retirement and estate protection.										
CO	)5	Describe financial products and	cts and strategies for long-term goals									
Unit No.		Content Contact Learning Outcome Hour							K	L		
I	Plannin Function Meanir control Time component	ons of money; Inflation- ng, causes, how it can be led; process official planning, value of money-simple and and interest; Net Present Value Future value, .Power of aunding; Doubling period and		Students w comprehend financial plan			abi		to of	2,	3	
п	Meanir Taxes, of Inco			Students will be able to understand and utilise the basic aspects of income tax and GST.					1,	2		
III	Meanir prerequ entrepr Suppor	Entrepreneurial planning — 6 Students will be able to understand the concept, scope and prerequisites of entrepreneurship t Systems in India, Institutional systems for entrepreneurs,					1,	2				

	entrepreneurs; Venture Capital,			
	Business Angels, Assistant of			
	Government, Commercial Bank Loans			
	and Overdraft.			
IV	Unit 4- Planning for investing in	6	Students will be able to analyse	3,4
	securities market –		and interpret the different	,
	Investment avenues offered by		dimensions of stock market	
	Securities Markets, Primary Market		investment.	
	and Secondary Market, Stock market-			
	meaning, features, functions of NSE,			
	BSE DEMAT trading account,			
	Security repository, stockbrokers,			
	Operational aspects of securities			
	markets: placement of orders, contract			
	note, pay-in and pay out, trading and			
	settlement cycle, Various risks			
	involved in investing in securities			
	markets; Role of Financial			
	Intermediaries; Stock indices. Mutual			
	Funds- meaning concept, definition,			
	types, importance and drawbacks of			
	mutual funds, mutual funds in India,			
	investing in mutual funds, Systematic			
	Investment Plan (SIP) and its			
	advantages.			
V	Unit 5- Planning for debts and	6	Students will be able to evaluate	1,2, 3
	Retirement		the aspects of retirement	, ,
	Consumer credit - Introduction to		planning to formulate effective	
	consumer credit; choosing a source of		strategic financial plans.	
	credit, the cost of credit alternatives,		,	
	Consumer Legal Protection; Housing			
	Decision: Factors and Finance; Vehicle			
	Decisions. Retirement planning -			
	Meaning of cost of living; retirement			
	need analysis; development of			
	retirement plan, various retirement			
	schemes, Estate Planning; Pension and			
	Medicare Planning; Wills.			

- T1. Sinha Pradeep K. and Priti Sinha. Computer Fundamentals: Concepts Systems & The Million-Dollar Financial Advisor: Powerful Lessons and Proven Strategies from Top Producers by David J. Mullen Jr
- T2. Personal Finance and Planning by Dr.Rajni
- T3. Peaceful Personal Finance: A Short Read on the Basics of Personal Finance and Planning Kindle Edition by Hema Singh
- T4. Be Your Own Financial Advisor: Financial Planning, Investment Options, Risk Management, Tax Management, Succession Planning Kindle Edition y Sushil Bali
- T5. The Dumb Things Smart People Do with Their Money: Thirteen Ways to Right Your Financial Wrongs Kindle Edition y Jill Schlesinger

	CO PO Mapping							
S.N.	Course Outcome (CO)	Mapped Program Outcome						
1	Explain the cash management and buying plan for homes or automobiles.	5						
2	Discuss a diversified investment portfolio for different objectives.	9						
3	Compare mutual funds, ETFs, and real estate investment options.	2, 5, 9						
4	Develop a financial plan for retirement and estate protection.	9						
5	Describe financial products and strategies for long-term goals	5						

			SEME	STER-III							
Cours	e Title		N	Iedical Mi	crobiolo	gy					
Course	e Code	24MSMB2104R	Total Credi Total Hours		P 3	T 0	P 2	S 0	R 0	O/F 0	C 4
Pre-re	quisite	Nil	Co-re	equisite		ı	ı	Ni	l		
Progra	amme		Master	of Science	in Micr	obiolo	ogy				
Semes	ter	Fa	ıll/ III semest	er of first	year of t	the Pr	ograi	nme			
Course Objectives		<ol> <li>To familiarize the students about the different diseases caused by bacteria &amp; viruses, fungi and parasites and prevention and control measures of the diseases.</li> <li>Explore the mechanisms by which microorganisms cause disease, including virulence factors, modes of transmission, and host-pathogen interactions.</li> <li>To teach different diagnostic tests to identify the causative organisms</li> </ol>									
C	201	Explain the norma epidemiology of infe			-		ence	facto	rs of	patho	gens,
C	O2	Describe the general clinical manifestation pathogenic bacteria.							•	•	•
C	О3	Describe the gener treatment, and proph		_		thoge	nicity,	labo	oratory	y diagr	nosis,
C	O4	Characterize fungi laboratory diagnosis	_	_		_	-	esis,	clinic	cal feat	tures,
C	O5	Summarize different	types of para	sites, their	life cycl	e, patl	nogene	esis ar	nd dia	gnosis.	
Unit No.		Content		Contact Hour	Le	earnin	ng Ou	tcome	9	K	L
I	respirat urogeni Infectio of patho	nal flora - Skin, mouth, upp atory tract, intestinal trace nital tract, eye. Transient flora. ion process and Virulence facto chogenic bacteria —toxins, enzymetal lar polysaccharides. Host pathogoction.		6	Under of di Learn and v pathog Explorinterac	sites.	1,2	2,3			
II	General characteristics, biochemical characteristics, virulence factors, pathogenicity, clinical manifestations, lab diagnosis, prophylaxis and treatment of Staphylococcus aureus, Streptococcus, Corynebacterium diphtheria, Bacillus, Clostridium, Vibrio cholera, E. coli, Salmonella spp, Shigella spp, Pseudomonas, Mycobacterium spp, Spirochaete, Mycoplasma, Rickettsiae, Chlamydiae, Listeria, Campylobacter, Helicobacter.			10	Under charactraits, bacter Analys clinica diagnot treatm pathog Apply disease manag	teristi virule ial pat ze the il man osis, p ent gens. the	ence hogen path nifesta prophy of know	ocher factor s. ogeni tions, laxis, bact	es of city, lab and rerial	1,2,	3,4

III	General properties, antigenicity, pathogenicity, laboratory diagnosis, treatment and prophylaxis of — Adenoviruses, Herpes viruses, Pox viruses, Hepatitis viruses, Oncogenic viruses, Polioviruses, Reoviruses, rotaviruses, arboviruses (togavirus and flavivirus, encephalitis, yellow fever, dengue). Influenza viruses, Mumps, Measles, Rubella, Rabies virus, HIV, Emerging and remerging viral diseases-Ebola, SARS, Corona, Chikungunya.	10	Analyse and evaluate the general properties, antigenicity, pathogenicity, laboratory diagnosis, treatment, and prophylaxis of various viruses.  Examine emerging and reemerging viral diseases, including Ebola, SARS, Corona, Chikungunya, and assess their impact on public health and control measures.	1,2,3,4,5
IV	Mycology, immunity, epidemiology, pathogenesis, clinical features, laboratory diagnosis and treatment of: Superficial cutaneous Mycoses- Dermatophytoses, Tinea nigra, Malassezia infection, Piedra Subcutaneous Mycoses - Mycetoma, Sporotrichosis, lobomycosis. Systemic Mycoses - Histoplasmosis, Blastomycosis, Coccidioidomycosis, paracoccidioidomycosis Opportunistic Mycoses -Candidiasis, Cryptococcosis, Aspergillosis, Zygomycosis Fungal toxins - Aflatoxins- Definition, major types of aflatoxins, symptoms and pathogenesis	10	Understand and Evaluate the mycology, immunity, epidemiology, pathogenesis, clinical features, laboratory diagnosis, and treatment of various mycoses. Understand fungal toxins, including aflatoxins—its definition, major types, symptoms, and pathogenesis.	1,2,3,4,5
V	Protozoology - Introduction toprotozoa, Amoebae — Entamoeba histolytica, Flagellates-Giardialamblia, Leishmania donovani.Sporozoa - Malarial parasites, Toxoplasma gondii, Blastocystishominis. Helminthology - Cestodes ortapeworms- Taenia saginata, Tinea solium, Trematodes or flukes- Fasciola hepatica, Fasciolopsis buski.Nematodes- Ascaris lumbricoides, Wuchereria bancrofti.	10	Gain knowledge on the fundamental concepts of protozoology and helminthology  Understand the classification, biology, and medical significance of various protozoa and helminths. Top of Form Bottom of Form	1,2,3,4,5
Practical	1. Study of different Biochemical tests – Indole, methyl red, voges proskeaur, citrate, Catalase, coagulase, oxidase, Mannitol motility test, hydrogen sulphide production, urease test, gelatin liquefaction test, fermentation of carbohydrates, triple sugar iron	30	Perform and interpret various biochemical tests, Assess antibiotic sensitivity using the Kirby-Bauer method and broth dilution method. Apply and analyze different	1,2,3,4,5,6

test, casein hydrolysis test.	staining techniques
Antibiotic sensitivity by Kirby-Bauer	Isolate and identify normal
method	flora from skin, nail
Antibiotic sensitivity by broth	scrapings, nose, throat, oral
dilution method	cavity, and ear samples.
Staining technique - Gram's, Acid	Use lacto phenol cotton blue
fast, Capsular, Endospore, Flagellar,	and KOH for fungal
Metachromatic granular staining	mounting and identification
Isolation of normal flora from skin,	Perform Leishman and
nail scrapings, nose, throat, oral	Giemsa staining
cavity and ear	
Fungal mounting by lacto phenol	
cotton blue and KOH	
Leishman staining, Giemsa	
<b>O</b> .	
	Antibiotic sensitivity by Kirby-Bauer method Antibiotic sensitivity by broth dilution method Staining technique – Gram's, Acid fast, Capsular, Endospore, Flagellar, Metachromatic granular staining Isolation of normal flora from skin, nail scrapings, nose, throat, oral cavity and ear Fungal mounting by lacto phenol

- T1. The Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill Livingston Company.
- T2. Medical Microbiology by Jawelz, Melnick, Geo R.Brokes Me Graw-Hill Company.
- T3. Medical Microbiology by Anantanarayan & Panekar, Orient Longman Limited.
- T4. Textbook Virology by Rhodes & Van Royen
- T5. Practical Microbiology by C.P. Baweja

#### **REFERENCE BOOKS:**

- R1. Bacterial Diseases by Wilson & Topley. Medical Microbiology by Cruckshank- Vol.I&Vol.II.
- R2. General Virology by Luria & Parnel Virology by Dimmock.

## **OTHER LEARNING RESOURCES:**

- 1. https://microbenotes.com/
- 2. https://www.youtube.com/

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Explain the normal flora of the human body, virulence factors of pathogens, epidemiology of infection, and host-pathogen interaction.	1, 2, 4					
2	Describe the general characteristics, biochemical traits, virulence factors, pathogenicity, clinical manifestations, laboratory diagnosis, prophylaxis, and treatment of various pathogenic bacteria.	1, 2, 3, 4, 9					
3	Describe the general properties, antigenicity, pathogenicity, laboratory diagnosis, treatment, and prophylaxis of various viruses.	1, 2, 3, 4, 9					
4	Characterise fungi with respect to epidemiology, pathogenesis, clinical features, laboratory diagnosis, and treatment of various fungal infections	1, 2, 3, 4, 9					
5	Summarize different types of parasites, their life cycle, pathogenesis, and diagnosis.	1, 2, 3, 4, 9					

			SEME	STER-III								
Course	e Title	M	icrobial Ecolog	y and Envi	ronme	ental	Micr	obiol	ogy			
Course	e code	24MSMB2105R	<b>Total Credits:</b>		L	T	P	S	R	0/		C
			Total Hours:		3	0	2	0	0	0		4
Pre-re		Nil	Co-requ					Γ	Vil			
Progra				of Science i								
Semest	ter		Fall/ III semest									
Cou	ırse	<ol> <li>To understand the</li> <li>To recognize mineral</li> </ol>		•	_					_	e.	
Objec	ctives	3. To understand n	•						•			
CO	<del>)</del>	Discuss various ec									efere	nce to
		ecological niches,		_					_			
CC	12	Asses the microbi	•	aquatic ecos	system	s, wa	astewa	ater ti	reatm	nent t	echn	iques,
	)	and microbial water	r quality.									
CC	)3	Establish the role of	-		-					-	al nit	rogen
		fixation through le										
CC	)4	Describe microbia	l Bioremediatio	n and their	role i	n the	e degi	adatio	on of	envi	ironn	nental
~		pollutants.  Illustrate microbial interactions and various biogeochemical cycles										
CC	)5	Illustrate microbial	interactions and	1	ogeoch	nemic	cal cyc	cles				
Unit No.		Content		Contact Hour	I	_earr	ning (	Outco	me		K	KL
I I	Micro	bial Ecology: Intera	ction between	15	Analy	ISP 1	nicrol	nial e	colo	σv	1 2	2,3,4
_	abiotic	<del></del>	etors in an	10	by	, 50 1		nderst			1,2	,,,,,,
	ecosys	tem, ecological ni	che, limiting		intera	ction				_		
		concept of communi	ty, fluctuation		and	bio	tic	facto	rs	in		
		ccession.			ecosy				logic			
	-	gical pyramid, energ	· <del>-</del>		niche		limitiı	U	facto	1		
		food webs and the	•		comn		•		ncep			
	Interac	ty and complexity	or ecosystem.		Explo		i, and		logic			
		en microbes and orga	nisms at other		pyran		energ		_			
	trophic	•	ommensalism,		chain		_	•		nd		
	mutua	lism, parasitism and j	predation with		ecosy	stem	l	dyı	namio	es,		
	examp				stability, and complexity.							
	Divers	•			Exam				crobi			
	communities in terrestrial (agricultura				intera			at '	vario	us		
and desert soil), aquatic (fresh water and marine water) and animal (cattle, termite					troph: Study		the	role	<b>.</b>	of		
	and	human being),	in extreme		decor							
		nments –	thermophiles,		logy,	_						
		ophiles, barophiles,	-		of air							
	_	hiles and halophil										
		posers, Microbiolo	••									
	enume	ration of air microflo	ra.									

TT	Agnatic Microbiology The equation	10	II. danston d the immest of	1 2 2 4 5
II	Aquatic Microbiology: The aquatic	10	Understand the impact of	1,2,3,4,5
	environment – major environmental		major environmental	
	conditions influencing microflora.		conditions on microflora in	
	Distribution of microorganisms in the		aquatic environments.	
	aquatic environments - freshwater		Explore the distribution of	
	environment, estuaries and marine		microorganisms in	
	environment. Microbiology of drinking		freshwater, estuaries, and	
	water, water pollution, purification of		marine environments.	
	water for human consumption.		Study the microbiology of	
	Assessment of microbial status in water		drinking water, including	
	and waste water. Wastewater		water pollution and	
	characteristics, Effluent treatment		purification methods for	
	processes (like trickling filter, activated		human consumption.	
	sludge, oxidative pond, anaerobic		Assess the microbial status	
	digestion and chemical disinfection),		in water and wastewater.	
	Bacterial indicators – DO, BOD, COD,		Understand wastewater	
	water purification		treatment process.	
			Evaluate bacterial indicators	
			such as Dissolved Oxygen	
			(DO), Biochemical Oxygen	
			Demand (BOD), and	
			Chemical Oxygen Demand	
			(COD) in water purification.	
			(COD) in water purification.	
III	Soil Microbiology: Soil microbes and	7	Understand the role of soil	1,2,3,4,5
111	soil fertility, Nitrogen fixation:	,	microbes in soil fertility and	1,2,3,4,3
	Biochemistry of Nitrogen fixation -		nitrogen fixation. Learn the	
	mechanism of nitrogenase -hydrogenase -		biochemistry and	
	Assay of nitrogen fixation -physiology of		mechanisms of nitrogenise	
			_	
	legume root nodule, leghemoglobin - Synthesis, Genes involved in nitrogen		and hydrogenase, assay methods for nitrogen	
	fixation			
	IIXation		fixation, and the physiology	
			and genetics of legume root	
			nodules and	
TX 7	B. L. C. C. d.	0	leghaemoglobin.	1 2 2 4 5
IV	<b>Bioremediation</b> – Factors affecting the	8	Understand bioremediation.	1,2,3,4,5
	bioremediation process, Bioremediation		Study the bioremediation of	
	of toxic waste sites; Bioremediation		toxic waste sites and the	
	practices and technologies; Bioleaching of		role of microbes in	
	copper, gold uranium Role of microbes;		bioleaching copper, gold,	
	Microbial degradation of environmental		and uranium.	
	pollutants- industrial solvents, pesticides,		Learn about microbial	
	petroleum hydrocarbons, xenobiotic; Bio		degradation of	
	deterioration – paper, textile, wood, metal,		environmental pollutants.	
	Corrosion – methods of protection Bio		Explore bio deterioration of	
	magnification		materials like paper, textile,	
			wood, and metal, methods	
			for corrosion protection, and	
			the concept of bio	

V	Microbial interaction: Competition,	5	Understand microbial	1,2,3,4,5
	ammensalism, parasitism, mutualism,		interactions. Explore the	
	commensalism, synergism, Biogeo-		roles of microbes in	
	chemical cycles - Carbon, Nitrogen,		biogeochemical cycles of	
	Phosphorus, Sulphur.		carbon, nitrogen,	
			phosphorus, and sulphur.	
	1. Isolation of air microbes by gravity	30	Proficiency in various	1,2,3,4,5,6
	settle method		environmental microbiolo-	
	2. Measurement of Ph		gical experiments.	
	3. Measurement of temperature		Determine DO, BOD, COD	
	4. Measurement of acidity and		Learn techniques for	
cal	alkalinity		preparing biofilms.	
Practical	5. Determination of DO		Conduct bacteriological	
Pra	6. Determination of BOD		examination of water.	
	7. Determination of COD		Isolate microorganisms	
	8. Preparation of biofilms		from soil and explore their	
	9. Bacteriological examination of water		applications.	
	10. Isolation of microorganisms from			
	soil and their application			

- T1. Environmental Microbiology by Eugene L Madsen
- T2. Environmental Microbiology, Blackwell Synergy, Blackwell publishing
- T3. Environmental Microbiology by P D Sharma, Alpha Science publishing
- T4. Environmental Microbiology by Alan and Malcolm

## **REFERENCE BOOKS:**

- R1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
- R2. Prescott, Harley and Klein's Microbiology.
- R3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Discuss various ecosystems and inhabiting microbial diversity with special reference to ecological niches, limiting factors, ecological pyramid, energy flow, trophic levels, etc.	1, 2, 4, 8
2	Asses the microbial diversity in aquatic ecosystems, wastewater treatment techniques, and microbial water quality.	1, 2, 3, 4, 8
3	Establish the role of microorganisms in soil fertility with reference to biological nitrogen fixation through leguminous plants and genes involved in nitrogen fixation.	1, 2, 4, 8, 9
4	Describe microbial Bioremediation and their role in the degradation of environmental pollutants.	1, 2, 4, 8, 9
5	Illustrate microbial interactions and various biogeochemical cycles	1, 2, 4, 8

	SEMESTER-III										
Cours	se Title		Soil and	Agricultur	al Micro	biolo	ogy				
Cours	se Code	24MSMB2106R	Total Credits:		L	T	P	S	R	O/F	C
			Total Hours:		3	0	2	0	0	0	4
	equisite	Nil	Co-requ		. D. #			Nil			
	ramme			of Science							
Semes	ster		Fall/ III semest						C'1 .		
Course Objectives		<ol> <li>To familiarize the students about the different types of soil and soil profile.</li> <li>To teach about the different types of microorganisms found in soil and their application in improvement of soil fertility.</li> <li>Understand microbial involvement in biogeochemical cycles, such as the nitrogen, carbon, phosphorus, and sulfur cycles, and their importance in soil fertility.</li> </ol>									
	TO1	Describe soil prof	files and dynar	nics of po	sitive an	d ne	gativ	e inte	eracti	ons be	tween
(	CO1	microbes and plants	S.	-							
C	O2	Explain the nitroge	n cycle, the role	of genes an	d enzym	es in	nitro	gen m	etabo	lism	
C	03	Discuss the princip	oles and applica	tions of bio	fertilize	rs, b	io pe	sticide	es, an	d plant	t gene
	.03	modification.									
C	04	Analyze host-paras	ite interactions,	and the rol	e of R ar	nd r g	genes	in dis	sease	develo	pment
		in plants.									
	O5	Identify post-harve	st diseases to im							<u> </u>	<b>.</b>
Unit		Content		Contact	Le	earni	ng O	utcon	1e		KL
No.	Coil m	rofile, types of m	.:	Hour 7	Underst	امسما	41	a a : 1		1. 1	2,3,4
-	found in Microbe interact Negativ siderop	n soil and plant surface plant interaction and types, re interaction and thores	ces on –positive	•	and id microor and plan Explore interact Study the	rganis rganis nt sur ions.	y thesms the faces of the faces	e typ found s. nicrob	in so	of oil nt	2,2,1
П	II Nitrogen cycle, Symbiotic and Non symbiotic Nitrogen Fixation, Nitrogenase enzyme and nif genes			7	cycle, if and no fixation of the nuther functions of the properties of the second control of the second contro	focus on-sy on-sy itrog oction cocess	ing of mbio derst enase of ses.	on syntic nand the enzym	itroge he ro me ar enes	ic en le id in	2,3,4
III	Bio fertilizers –types (free livin soil microbes fixing N2 (Azotobacter, Azospirillum), Rhizobium, Azorhizobium, Bradyrhizobiumin symbiotic association with leguminous plants.  Free living cyanobacteria- Nostoc, Anabaena.  Associative cyanobacteria (symbionts)- Anabaena azollae, Azollaas Biofertilizer) Biopesticides and types (Bacteria- Bacillus thuringiensis, Bt based commercial products, Beauveria			15	Underst function Learn a Explore techniq importa Agroba transfer	ns of bout pla ues, nce o	bio fo bio p nt tr focu of Ti	ertilize esticion ansfor sing plasn	ers les matic on th	on ne nd	2,3,4,5

	bassiana, Trichoderma,			
	Baculoviruses for insect pest control			
	-Nuclear polyhedrosis virus) Plant			
	transformation- Ti plasmid and its			
	importance, Agrobacterium mediated			
	gene transfer			
IV	<b>Host parasite interaction</b> , production of	8	Understand host-parasite	1,2,3,4
	phytoalexins, involvement of elicitors,		interactions, including the	
	role of R and r genes in disease		production of phytoalexins	
	development, Plant disease -bacterial -		and the involvement of	
	blight of rice, citrus canker, viral – TMV,		elicitors. Explore the role of R	
	Banana bunchy top, fungal-wilt, downy		(resistance) and r	
	mildew, powdery mildew, smut and rusts,		(susceptibility) genes in	
	mycoplasmal – sandal spike, grassy shoot		disease development. Study	
	of sugarcane		plant diseases caused by	
			various pathogens	
V	Postharvest disease and control measures	8	Identify post-harvest diseases	1,2,3,4
'	1 ostilar vest disease and control measures	Ü	and their control measures,	1,2,5,1
			focusing on strategies to	
			prevent and manage diseases	
			affecting harvested crops and	
			produce.	
	1 T 1 ( C )	20	1	1.0.0
	Isolation of nitrogen fixing bacteria	30	Isolate nitrogen-fixing	1,2,3,
	from legume root nodules		bacteria from legume root	4,5,6
	2. Study of Rhizosphere and		nodules. Isolate phosphorus-	
	Phyllosphere		solubilizing microorganisms.	
ica	3. Isolation of Phosphorus solubilizing		Study the rhizosphere and	
Practical	microorganisms		phyllo sphere environments.	
Pr	4. Observation of Anabaena from		Observe Anabaena from	
	Azolla plants		Azolla plants. Observe root	
	5. Microscopic observations of root		colonization by VAM	
	colonization by VAM fungi		(Vesicular-Arbuscular	
			Mycorrhizal) fungi.	

- T1. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley &Sons Inc. New York & London.
- T2. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi

# **REFERENCE BOOKS:**

- R1. Microbiology Michael J. Pelczar, JR. E.C.S.Chan Noel K. Krieg, Vth Edition (2005), Publisher TATA McGraw Hill.
- R2. Plant Diseases R.S. Singh, IXth Edition, Oxford and IBH (N. Delhi)

## **OTHER LEARNING RESOURCES:**

**1.** http://www.jnkvv.org/PDF/02042020180252Yogranjan_Lecture%20notes_Agricultural%20Mi crobiology.pdf

	CO PO Mapping						
S.N.	Course Outcome (CO)	Mapped Program Outcome					
1	Describe soil profiles and dynamics of positive and negative interactions between microbes and plants.	1, 2, 4					
2	Explain the nitrogen cycle, the role of genes and enzymes in nitrogen metabolism	1, 2, 3, 4					
3	Discuss the principles and applications of bio fertilizers, bio pesticides, and plant gene modification.	1, 2, 3, 4, 9					
4	Analyse host-parasite interactions, and the role of R and r genes in disease development in plants.	1, 2, 3, 4, 9					
5	Identify post-harvest diseases to implement effective control measures.	1, 2, 4, 8					

		SEMESTER-III										
Course	e Title		Clin	ical and D	iagnostic Microl	biol	ogy					
Course	. Code	24MSMB2107R	Tota	d Credits:	4	L	T	P	S	R	O/F	C
Course	Couc	24WISWID2IV/K	Tota	d Hours: 4	15T+30P	3	0	2	0	0	0	4
Pre-requisite Nil Co-requisite										Nil		
Progra	mme		M	aster of Sc	ience in Microbi	olo	gy					
Semest	Semester Fall/ III semester of first year of the Programme											
	ırse ctives	<ol> <li>To teach the importa</li> <li>To make students pro</li> <li>To analyse the nature</li> </ol>	oficier	nt in isolatio	on and characteriz	zatio	on o	f in	fect	ious c		ms.
CO	<b>D1</b>	Apply the skills of hand from clinical samples.	dling	clinical spe	ecimens, isolating	gan	d id	ent	ifyiı	ng mi	croorg	anisms
CC	)2	Perform different imm microbiology	unolo	gical techr	niques using imi	mun	odia	agn	osti	c tool	ls in c	clinical
CC	)3	Describe the concept of	vacci	ne and its e	ffectiveness and	safe	ty c	onc	ern			
CO	)4	Apply the advanced diag	gnosti	c tools and	techniques for di	seas	se di	iagr	osis	S		
CO	)5	Illustrate the concept	of an	timicrobial	chemotherapy,	mod	le o	of a	actio	n, ar	nd sen	sitivity
	<i>)</i> 5	pattern.										
Unit		Content		Contact	Learni	ng (	Out	con	ne			KL
No.	Introd	luction to clir	nical	Hour 10	Understand	the		role	`	of	1	, 2, 3
1		<b>biology</b> : Role	of	10	microbiologist	ii		a		iagnos		, 2, 3
		biologist in Diagno			laboratory and					_		
		tory, General concepts			*	collection, handling						
	specin	•			transportation,						_	
	•	ortation, process	•		up. Learn abou	_		_				
	_	nen work up, Labora	•		infection contro			,		J		
	safety	_	itrol.		Gain insights in	nto	the	sci	enti	fic an	d	
	Scient	ific and Laboratory basis	s for		laboratory b	asis		of	(	clinica	al	
		al/ Diagnostic Microbiol	ogy:		microbiology, i	nclu	din	g n	nicro	oscopi	c	
	Micros	_	of		examination of		fecti					
		ous diseases, Growth			$\mathcal{C}$	nd .				emica		
		mical characteristics, R	apıd		characteristics,	and	rap	1d 1	netr	iods c	01	
II		ds of identification inotechniques	and	7	identification.  Understand a	nd	or	ply	, ,	variou	ıc 1	2, 3, 4
11		unodiagnosis: Antigens		,		na tech	•			an		2, 3, 4
	Antib		immunodiagnos		_		S					
		lutination, complement										
	fixatio	on, ELISA, Western Blot										
		nodiffusion, Immu	uno-									
		ophoresis,										
	Immunofluorescence,											
		noprecipitation,										
		oimmuno-assay,										
	and se	erotyping.										

III	Vaccines and Vaccination:	8	Understand vaccines and vaccination	1, 2, 3,
	Vaccines – definition, types,		by exploring types, antigens used,	4, 5
	Antigens used as Vaccines,		effectiveness, safety, current	
	effectiveness of vaccines, Vaccine		vaccines, adjuvants, and the	
	safety, current vaccines, adjuvants,		differences between active and	
	active immunization and passive		passive immunization. Top of Form,	
	immunization.		Bottom of Form	
IV	Recent Diagnostic tools and	10	Understand recent diagnostic tools	1, 2, 3,
	techniques: Principle, working		and techniques, including auto	4, 5
	and application of a) Autoanalyser		analysers, biosensors (glucometers,	
	b) Biosensor glucometer/ labon		lab-on-a-chip, microfluidics),	
	chip/ microfluidics c) Diagnositic		diagnostic kits (ELISA, Western	
	kits- ELISA, Western Blot		Blot), and the role of enzymes	
	d)Enzymes in Disease diagnosis		(lactate dehydrogenase, aspartate	
	and therapy: Lactate		aminotransferase, alkaline	
	dehydrogenase, Aspartate		phosphatase, creatine kinase, acid	
	aminotransferase,		phosphatase, cholinesterase) in	
	Alkaline phosphatase, Creatine		disease diagnosis and therapy.	
	kinase, Acid phosphotase,			
	Cholinesterase			
V	Antimicrobial Chemotherapy:	10	Understand antimicrobial	1,2,3,4,5
	Development of chemotherapy;		chemotherapy by exploring their	
	General characteristics of drugs and		mechanisms of action, and the	
	their testing; Mechanism of action.		specifics of antibacterial, antifungal,	
	Antibacterial drugs; antifungal		antiviral, and antiprotozoan drugs,	
	drugs, antiviral and antiprotozoan		including antibiotic sensitivity	
	drugs; antibiotic sensitivity testing,		testing, MIC, and mechanisms of	
	MIC, Drug resistance; mechanism		drug resistance, including multi-drug	
	of drug resistance; multi drug		resistance.	
	resistance.			
	1. Study of sample collection	30	Learn sample collection, storage, and	1,2,3,
	procedure, Storage protocol,		processing procedures. Isolate	4,5,6
	Processing.		pathogens from clinical samples and	
	2. Isolation of pathogen from		perform antibiograms, conduct	
न्न	clinical sample and its		serological tests.	
Practical	antiprogram		Handle rapid diagnostic kits.	
-}ra	3. Serological test,		Study the nature of antibiotic	
	4. Handling and working of rapid		actions, and analyze antibiotic	
	diagnostic kits.		resistance.	
	5. Study of nature of antibiotics			
	actions. Detection and analysis of			
	antibiotic resistance			

- T1. Medical Microbiology by Anantanarayan & Panikar Orient Longman Limited.
- T2. Medical Parasitology by Arora and Arora, CBS Publishers & Distributors.

## **REFERENCE BOOKS:**

- R1. Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill Livingston Company.
- R2. Parasitology by K. P. Chattergy Medical Microbiology by Jawelz, Melnick, Geo R. Brokes MeGraw-Hill Company.
- R3. Medical Mycology by Jagedeese Chander
- R4. Medical Microbiology by Jawetz

CO PO Mapping		
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Apply the skills of handling clinical specimens, isolating and identifying microorganisms from clinical samples.	1, 3, 4, 6, 7
2	Perform different immunological techniques using immunodiagnostic tools in clinical microbiology	1, 3, 4, 6, 7
3	Describe the concept of vaccine and its effectiveness and safety concern	1, 3, 4, 6
4	Apply the advanced diagnostic tools and techniques for disease diagnosis	1, 3, 4, 6, 7
5	Illustrate the concept of antimicrobial chemotherapy, mode of action, and sensitivity pattern.	1, 3, 4, 6, 7, 9

SEMESTER-III														
Cours	e Title		Or	ganic Farmin	g									
Cours	e code	24MSMR2108R	otal Credits:	ļ	L	T	P	S	R	O/F				
Pre-re	quisite	Nil	otal Hours: Co-req		3	0	2	0 Ni	0	0	4			
		1411	-		nobio	logy	,	111	1					
Progra		F-11/		Master of Science in Microbiology  semester of first year of the Programme										
Semes	ter				tne	Prog	ram	me						
	ourse ectives	<ol> <li>Introduction to Concept</li> <li>To discuss the Organic</li> <li>To discuss the method tillage, bio-fertilizer et</li> </ol>	Farming Sysods associated	tem (OFS), its	•					op ro	tation			
C	O1	Explain organic Farming, its principles, scope and benefits for the health and society.												
C	O2	cycles, soil preparation as	Illustrate the relation between organic farming and natural processes such as nutrient cycles, soil preparation and choice of crop varieties, planting material and seed treatment.											
C	О3	Discuss crop protection methods, analyses scenarios, propose strategies and evaluate												
			ffectiveness, preparing to innovate in pest and weed management.  xplain the organic production of rice, zinger, turmeric, banana and vegetables.											
	O4 O5	Describe the concept of s			ic, ba	ınana	and	vege	iables	<b>5.</b>				
Unit		<u>*</u>	Contact								KL			
No.		Content	Content Hour Learning Outcome											
I	(OF); Develop Princip Farmin Need Farmin (CF) V Farmin OF Sy Choice Propaga materia rotation Manage Mulchin	and Benefits of Organg; Conventional Farmiss (OF); Scope of Organg.  stem; Soil and Soil tilla of crop/ varietted ation —Seed, plantal and seed treatments, Can, Intercropping, Water of Green Manuring, Composting, Organic Manufolds	nic nic nic nic nic nic nic nic nic nic	Understand organic farming by exploring its development, principles, and types, including biodynamic farming, its benefits and needs, and comparing conventional farming (CF) with OF, along with the scope of organic farming. Top of Form Bottom of Form  Understand the organic farming system by exploring soil and tillage practices, crop selection and propagation, crop rotation, intercropping, water management, and techniques such as green manuring, mulching, composting, vermicomposting, organic manure, and bio fertilizers.							1,2,3, 4,5			
III	of crop Botanic	l and Mechanical meth protection, Biopesticides a al Pesticides, Bio- cont Weed Management	and	methods, including cultural and										
IV	_	<b>,</b>	ce, 17	Learn organi for rice, gin vegetables.					_		1, 2, 3			

V	Concept on mode	6	Explore	farming	1, 2, 3,			
	methods -	Hydroponics,		methods,	includi	droponics,	4, 5	
	Aquaponics, Hyd	lroponics		aquaponio	cs, and verti	cal farming	g.	

- T1.The Market Gardener A successful Grower's Handbook for Small- Scale OF (2014), Jean-Martin Fortier
- T2. Profitable OF (2004), Jon Newton
- T3.Organic Farming for Sustainable Agriculturs (2016) Dilip Nandwani (eds)

# **REFERENCE BOOKS:**

- R1. Organic Farming: Concepts and Principles (2011) G. K. Veeresh and G.K. Veerash
- R2. Organic Farming: New Advances towards Sustainable Agriculture Systems (2019). C. Sarath Chandran, Sabu Thomas. M.R. Unni

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Explain organic Farming, its principles, scope and benefits for the health and society.	1, 4, 9
2	Illustrate the relation between organic farming and natural processes such as nutrient cycles, soil preparation and choice of crop varieties, planting material and seed treatment.	1, 2, 3, 8, 9
3	Discuss crop protection methods, analyse scenarios, propose strategies and evaluate effectiveness, preparing to innovate in pest and weed management.	1, 2, 3, 4
4	Explain the organic production of rice, zinzer, turmeric, banana and vegetables.	1, 4
5	Describe the concept of soil less farming system.	1, 2, 3, 4, 8, 9

		SEMESTER – IV									
Course Title	MINI RESEARCH - IV (RESEARCH DATA ANALYSIS AND										
Course Title	DOCUMENTATION-R4)										
Course Code	24MSMB2201R	Total Credits: 12	L	T	P	S	R	O/F	C		
Course Code	24MSMD2201K	Total Hours: 360 (P+S+R)		0	20	4	6	0	12		
Pre-requisite	Nil	Nil Co-requisite Nil									
Programmes		Master of Science in Biotechnology									
Semester	Spr	ing/II Semester of First Year of	the	Pro	gram	me					
Course	1. To enable students to apply experimental methods to solve a given scientific task.										
Objectives	2. To be able to analyse research data										
Objectives	3. To be able to com	3. To be able to compile and document research data.									
CO1	Learn to tabulate rese	earch data									
CO2	Analyze research out	comes									
CO3	Correlate with exiting	g literature									
CO4	Prepare an effective of	dissertation report									
CO5	Able to communicate	e research outcome									

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Learn to tabulate research data	1, 2, 3, 4, 6, 7, 9							
2	Analyse research outcomes	1, 2, 3, 4, 6, 7, 9							
3	Correlate with exiting literature	3, 4, 6, 7, 9							
4	Prepare an effective dissertation report	1, 2, 3, 5, 6, 7, 9							
5	Able to communicate research outcome	5, 6, 9							

			SEMES	TER-IV									
Cours	se Title	Inc	dustrial M	icrobiolog	y and Ferr	nent	tatio	n					
Cours	se Code	24MSMB2202R	Total Cre Total Ho	edits: 3 urs: 33T+	30P	L 2	T 0	P 2	S 0	R 0	O/F 0	<b>C</b> 3	
Pre-re	equisite	Nil	C	o-requisit	e				Nil		1	1	
	amme		Master o	r of Science in Microbiology									
Semes	ster	Spring/I	V Semeste	er of secon	d year of t	he P	rog	ram	me				
	ourse jectives	<ol> <li>To familiarize the students with the concept of fermentation processes &amp; the use of different microorganisms in industries.</li> <li>Understand the principles, types, and design of fermentation processes, including submerged and solid-state fermentation.</li> <li>To teach the students about the different industrial products produced by microorganisms.</li> </ol>											
(	CO1	Explain the principles of	diverse bio	oreactors ar	nd their adv	anta	ages						
(	CO2	Illustrate different microl applications.  Illustrate various fermen involved.	bial strain i	improveme	nt strategie	es an	d th	e de					
(	CO4	Describe various downstr	ream proce	esses and th	eir storage	and	pac	kagii	ng te	chnic	iues.		
	CO5	Explore the potential of u					_						
Unit	T T	Content	ising intere	Contact					come			KL	
No.		Content		Hour	Le	a1 III	ıng v	Ouit	Joine			KL	
I	General	Principles	of	8	Understai	nd	vari	ious	typ	es o	of 1	1, 2,	
	Fermentation: Bioreactors: Bioreactor types, immobized bioreactors, types of fermentation. Fermentation kinetics and Monods Model:-Growth kinetics and Monod's Model, Substrate accelerated death, specific growth rate, stringent response, Ntr and Pho system, growth limiting substrate, maintenance energy, growth yield and product formation. Process optimization: factors of optimization, rheology of fermentation fluid, oxygenation, and oxygen transfer				bioreactor application Comprehe the principal Identify of the optimal processes	ons. end ples key nizat	of N	Mono tors	kineti od's l influ	Mode encir	nd el.	3, 4, 5	
П	kinetics.				Learn tee and isol from vari Understan important secondary Learn te microbial yield and products.	latin ous nd t ce y me echn str d ef	envi the of etabo ique	micr ronn prod pri olites es to	nents luction mary 	anisn  on ar  ar  nprov	and and and are ed	1, 2, 3, 4, 5	

III	Industrial Fermentation Products	8	Understand the process of	1, 2,
	Biofuels:-Ethanol, Hydrogen, Methane		fermentative production of	3, 4,
	Antibiotics:-β-lactum antibiotics (Synthetic		biofuels, antibiotics, bio	5
	Penicillin), Streptomycin, Cephalosporin.		preservatives, biopolymer,	
	Bio preservative: Lactobacillus sakei.		enzymes, bio surfactants from	
	Biopolymers:-Xanthan,		microbial sources.	
	Polyhydroxyalkanoates.			
	Thermostable enzymes:- Proteases.			
	Biosurfactants: a comparative account.			
IV	Downstream Processing and scale up:	4	Understand different types of	1, 2,
	Downstream processes: types of processing		processing units and systems	3, 4,
	units and systems, Storage and packaging		used in downstream processing.	5
	methods. Scale up: criteria involved in		Analyse factors affecting	
	scale up, Productivity, power requirements,		productivity and power	
	Basic control theory		requirements during scale-up.	
V	Food and Healthcare products: SCP,	7	Understand the various types of	1, 2,
	various types and processes, SCO		SCP and SCO, and the processes	3, 4,
	Aminoacids:-Lysine, Glutamic acid.		involved in their production.	5
	Vitamins:-riboflavin, Vit.B12. Fatty acids		Gain knowledge on the	
	(Palmetate, oleate). Organic acids		biosynthesis and industrial	
	Production of Fuels: Ethanol, Methanol		production of vitamins, amino	
	Mushroom Cultivation and Wine		acids, organic acids, wine, fatty	
	production		acids, and biofuels.	
			Understand the techniques and	
			processes involved in mushroom	
		20	cultivation.	
	1. Yoghurt production	30	Perform fermentative production	1, 2,
_	2. Yeast Fermentation		of yoghurt, wine, vinegar, SCO,	3, 4,
Practical	3. Wine preparation		SCP	5
rac	4. Vinegar production		Estimate Citric acid and lactic	
$\mathbf{P}_{\mathbf{I}}$	5. Single cell Protein and Single Cell Oil		acid produces through	
	6. Citric acid estimation		fermentation	
	7. Lactic acid estimation			

- T1. Stanbury P.F., A. Whitaker, S.j. Hall, Principles of Fermentation Technology Publisher: Butterworth-Heinemann
- T2. Shuler M.L. and F. Kargi: Bioprocess Engineering Basic Voncepts by Publisher Prentice Hall

# **REFERENCE BOOKS:**

R1.Prescott and Dunn's Industrial Microbiology, Publisher: Gerald Reed: Books

R2.W. Crueger and A. Crueger: Biotechnology. A textbook of Industrial Microbiology, Publisher: Sinauer Associates.

# **OTHER LEARNING RESOURCES:**

- 1. https://microbenotes.com/
- 2. www.youtube.com

	CO PO Mapping	
S.N.	Course Outcome (CO)	Mapped Program Outcome
1	Explain the principles of diverse bioreactors and their advantages	1, 3
2	Illustrate different microbial strain improvement strategies and the development of novel applications.	1, 2, 3, 4, 9
3	Illustrate various fermentation products and the underlying biotechnological principles involved.	1, 2, 3, 4, 9
4	Describe various downstream processes and their storage and packaging techniques.	1, 2, 3, 4, 9
5	Explore the potential of using microbes to produce metabolites in industrial settings.	1, 2, 3, 4, 8, 9

			SEME	STER-IV									
Cours	e Title		Food	and Dairy	Microbiolog	y							
Cours	e Code	24MSMB2203R	Total Cred			L	T	P	S	R	O/F	C	
			Total Hou			2	0	2	0	0	0	3	
	quisite	Nil		Co-requisit					Ni	il			
Progra					in Microbiol								
Semes	ter	- '			d year of the								
	urse ectives	<ol> <li>The course provides issues of food safety</li> <li>The course provid determination and content of the course provides are the course</li></ol>	contents of the food microbiology field and specific professional skills  2. The course provides an integrated overview of the field of food microbiology covering issues of food safety, food preservation and food production.  3. The course provides insights concerning aspects of microbial ecophysiology, determination and control of food microorganisms, and the distribution of spoilage and pathogen microorganisms in plant- and animal-based food.										
C	CO1 Describe the significance of microorganisms in food and their relation to spoilage									•			
C	CO2 Apply the principles and techniques employed in the preservation of foods.												
C	203	Analyze the role of mic prebiotics	crobes in foo	d productio	on, and explor	e tł	ne co	nce	ot of	prob	oiotics	and	
C	<b>O</b> 4	Characterize different food-borne illnesses and associated microorganisms.											
C	05	Demonstrate safety mea	asures and co	ontrol progr	rams in food J	oro	ducti	ion					
Unit No.		Content		Contact Hour	Lear	nir	ng O	utco	me			KL	
I	substrat microor general spoilage <b>Food</b> preserve product	Contamination- con ation, and spoilage s/vegetables & fruits/ m s/ milk & milk produc	important crobiology, ing food tamination, of cereal teat & meat	7	Understand the role of food as a substrate for microorganisms, identify key microorganisms in food microbiology, learn the principles of food spoilage, and gain knowledge on contamination, preservation, and spoilage prevention methods for various food products							, 2, 5, 4, 5	
III	Princip asepsis, preserve tempera radiatio	les of Food Preservation removal, anaerobic ation by high temperate ature/ drying/ food n	condition,	5	Apply the principles of food preservation, including asepsis, removal of contaminants, creation of anaerobic conditions, and methods such as high temperature, low temperature, drying, use of food additives, and radiation.								
111	Microo cultures enzyme Probio	rganisms- producti , food fermentation, s from microorganisms tics & Prebiotics- function	ons of foods &	O	Understand of food fer probiotics functions, ty in products milk, yogur formulas.	men and ype su	ntati l pi es, ai	on 1 rebicand a	earn tics, ppli acido	abo the cation	ut 3 eir ns us	, 2, 5, 4, 5	

IV	Foods in Relation to Disease- bacterial	5	Correlate food borne disease and	1, 2,
	food borne illnesses, non- bacterial food		their causative agents and factors	3, 4,
	poisoning/infections/ intoxication, food		contributing to food poisoning	5
	borne disease outbreaks			
V	Food Sanitation, Control &	7	Understand the principles of food	1, 2,
	Inspection- sterilization, microbiology		sanitation, including sterilization	3, 4,
	in food sanitation, enforcement & control		and the role of microbiology, and	5
	agencies- national/ international/ federal/		become familiar with the	
	state/ private, Microbiological criteria for		enforcement and control agencies	
	food		at national, international, federal,	
			state, and private levels, as well as	
			the microbiological criteria for	
			food safety.	
	1. MBRT of milk samples and their	30	Assess milk quality, isolate food	1, 2,
	standard plate count.		borne microorganisms.	3, 4,
	2. Isolation of food-borne bacteria and		Estimate MPN	5
	fungi from food products.		Perform microbial examination of	
	3. Most Probable Number Analysis		food.	
	4. Microbiological examination of canned		Perform adulterant test	
cal	foods		Able to produce fermented food	
Practical	5. Isolation of spoilage bacteria from fruits and vegetables.			
	6. Adulterant test – formalin and starch			
	test			
	7. Effect of temperature on the spoilage of			
	food products.			
	8. Production of fermented food and their			
	microbial examination			

- T1. Frazier W.C. and West off D.C. (2008) Food Microbiology, 4th Edn. Tata McGraw Hill Publishing Co., New Delhi.
- T2. Bamforth C.W. (2005) Food, Fermentation and Microorganisms, Blackwell Science

# **REFERENCE BOOKS:**

- R1. Doyle M.P. and Buchanan R.L. (Ed.) (2013) Food Microbiology: Fundamentals and Frontiers, 4th Edn. ASM press.
- R2. Jay J.M., Loessner M.J. and Golden D.A. (2005) Modern Food Microbiology, 7th Edn. Springer Publishers
- R3. Robinson R.K. (2002) Dairy Microbiology: Milk and Milk Products, 3rd Edn. Wiley Publishers.

	CO PO Mapping								
S.N.	Course Outcome (CO)	Mapped Program Outcome							
1	Describe the significance of microorganisms in food and their relation to spoilage	1,4							
2	Apply the principles and techniques employed in the preservation of foods.	1, 2, 4							
3	Analyse the role of microbes in food production, and explore the concept of probiotics and prebiotics	1, 2, 3, 4							
4	Characterize different food-borne illnesses and associated microorganisms.	1, 2, 4, 9							
5	Demonstrate safety measures and control programs in food production	1, 2, 4, 9							

SEMESTER-IV												
Cours	se Title		Pha	rmaceutic	al Microbiol	ogy						
Cours	se Code	24MSMB2204R		Credits: 3		L	T	P	S	R	O/F	C
Pre-r	equisite	Nil	1 otai	Hours: 32 Co-requ		2	0	2	0 N	0     Iil	0	3
	ramme	1411	Maste		ce in Microbi	iolos	ρv		1	(11		
Seme		Spring			cond year of t	`	_•	gran	nme			
	ourse jectives	<ol> <li>To teach the basic de</li> <li>To understand the n         pharmaceutical prode     </li> <li>To incorporate in dej         avoid any potentially     </li> </ol>	nechanisn ucts oth know	n of action	of antibiotic	cs an	nd t	he n	node strate	of s	spoilag in orde	
(	CO1	Explain pharmacology a										
	CO2	Describe the mode of antibiotics.	•			path	oger	nicity	y, an	nd re	sistanc	e to
(	CO3	Explore microbial pharm	naceutica	l products,	and their spo	oilag	e.					
(	CO4	Execute Good manufact	turing pra	ctices, qua	lity assurance	e, an	d qu	ıality	y con	trol.	-	
(	CO5	Apply different physical pharmaceutical industry		emical ster	rilization tech	ıniqı	ies 1	to er	isure	ster	ility in	the
Unit No.		Content		Contact Hour	Le	arni	ing (	Out	come	e		KL
_	I Introduction to pharmacology:  Definitions, sources, terminology used, classification, Pharmacodynamics — Actions, Therapeutic, Adverse, toxic Pharmacokinetics — absorption, distribution, metabolism, interaction, excretion, Routes of drug administration, Storage of various drugs			7	pharmacology, including defin sources, terminology, classific pharmacodynamics (ac therapeutic, adverse, toxic ef pharmacokinetics (absor- distribution, metabolism, intera- excretion), routes of						ition, ions, ects), otion,	1,2, 3,4, 5
II	Mechanism of action of antibiotics:  Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis). Bacterial resistance to antibiotics. Mode of action of bacterial killing by quinolones. Bacterial resistance to quinolones.			5	Understand the mechanisms of a of antibiotic. Comprehend bacterial resistant antibiotics and quinolones							1,2, 3,4, 5
Ш	pharmac contamir pharmac injectable preparati sterilizati and	parations and implants) and their pharmaceuticals; rilization. Manufacturing procedures Gain knowledge on pharmaceutical								and of ticals ions	1,2, 3,4, 5	

TX/	produced by microbial fermentations (streptokinase, streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.		Understand the process of vaccine clinical trials.	1.2
IV	Principles and applications of GMP in pharmaceuticals and cosmetics:  Principles – Applications and Definitions, The concept of Quality, The regulatory factors QC, QA and GMP, Quality assurance beyond Good Manufacturing Practices (GMP), ISO, Sanitary practices in cosmetic manufacturing	6	Understand the principles, applications, and definitions related to quality in pharmaceutical and cosmetic manufacturing; Grasp the concept of quality and the regulatory factors involved, including Quality Control (QC), Quality Assurance (QA), and Good Manufacturing Practices (GMP); Explore quality assurance practices beyond GMP, learn about ISO standards. Understand sanitary practices in cosmetic manufacturing.	1,2, 3,4, 5
V	Sterilization and sterility assurance: Sterilization control and sterility testing (heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization) Chemical and biological indicators. Design and layout of sterile product manufacturing unit. (Designing of Microbiology laboratory).	7	Understand sterilization control and sterility testing methods, Learn about chemical and biological indicators used in sterility testing; Comprehend the design and layout of sterile product manufacturing units, including the design principles for microbiology laboratories.	1,2, 3,4, 5
Practical	<ol> <li>Antimicrobial assay of antibiotics - determine MIC</li> <li>Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations).</li> <li>Determination of antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardized experimental conditions.</li> <li>Determination of D value, Z value for heat sterilization in pharmaceuticals.</li> <li>Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations).</li> </ol>	30	Determine the Minimum Inhibitory Concentration (MIC) of antibiotics through antimicrobial assays. Perform microbial contamination and load testing of pharmaceuticals, including syrups, suspensions, creams, ointments, and ophthalmic preparations.  Evaluate and compare the antimicrobial activity of chemical compounds (e.g., phenol, resorcinol, thymol, formaldehyde) against phenol under standardized experimental conditions.  Measure D value and Z value for heat sterilization in pharmaceutical products to ensure effective sterilization.	1,2, 3,4, 5

- T1. Pharmaceutical Microbiology by Hugo & Russell, Blackwell Science Publication, 6th Edition
- T2. Pharmaceutical Microbiology: Essentials for Quality Assurance and Quality Control by Tim Sandle, Woodhead Publishing.

#### **REFERENCE BOOKS:**

- R1.Pharmacology by Harvey and Champe, Wolters Kluwer Publication, 4Th Edition
- R2. Principles of Pharmacology, Armstrong, Wolters Kluwer Publication
- R3.Basic and Clinical Pharmacology, by Katzung, McGraw Hill, 10th edition
- R4.Pharmacology, Principles and Practice, Bachmann, Hecker, Messer, AP Publication
- R5. Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II. Academic PressNew York.
- R6.Quinolinone antimicrobial agents Edt. by David C. Hooper, John S. Wolfson .ASMWashington DC.
- R7.Quality control in the Pharmaceutical Industry Edt. by Murray S.Cooper Vol.2.Academic Press New York.

#### **OTHER LEARNING RESOURCES:**

1. https://www.carewellpharma.in/B_Pharmacy/Notes/3rd_Sem/Microbiology/Unit1/ www.youtube.com

	CO PO Mapping					
S.N.	Course Outcome (CO)	Mapped Program Outcome				
1	Explain pharmacology and pharmacokinetics.	1				
2	Describe the mode of action of antimicrobial agents, pathogenicity, and resistance to antibiotics.	1, 2, 4				
3	Explore microbial pharmaceutical products, and their spoilage.	1, 2, 3, 4, 9				
4	Execute Good manufacturing practices, quality assurance, and quality control.	1, 6, 7, 9				
5	Apply different physical and chemical sterilization techniques to ensure sterility in the pharmaceutical industry.	1,3				

	SEMESTER-IV											
Course Title Marine Microbiology												
Course	no Codo	24MSMB2205R	redits: 3			T	P	S	R	O/F	C	
Course Code		24WISWIB22USK	Total Ho	ours: 32T+	-30P	2	0	2	0	0	0	3
<b>Pre-requisite</b>		Nil		Co-requis					Ni	l		
Progr	amme		Master	r of Science	in Microbi	olog	gy					
Seme	ster	Spring/IV Semester of second year of the Programme										
_	ourse	1. To develop the knowledge about the biology of marine microbes and their distribution.										
Obj	ectives	2. To understand the role of marine microorganisms.										
	~~.	3. To explore potential of marine microorganisms.										
	CO1	Describe the distribution and significance of marine cyanobacteria and actinomycetes.										
	CO2	Explain the marine eukaryotic microbial cell structure and functions.										
	CO3	Discuss the role of marine microorganisms in ocean acidification and sedimentation.										
(	CO4	Characterize marine vir	Characterize marine viruses and virus-like particles.									
(	CO5	Explore the role of marine microorganisms in the production of various bioactive										
		compounds										
Unit		Content		Contact	t Learning Outcome				K	L		
No.	0	una and diatmilastica atma		Hour 5	Understand	1	41		~		1, 2	. 2
1		nce and distribution, stru- ecological role and sig	5			the		curre	-	1, 2	., s	
		arine cyanobacteria,			n, structure, biology, role, and significance							
	actinomy	,	of marine cyanobacteria and									
		,	marine actinomycetes									
	2.6		_	G : :	ntroduction to marine				1.0			
II		eukaryotic microbes:	7					o ma	rine	1, 2		
		tion to the protists and fu w of eukaryotic cell struc		eukaryotic Understand			aryot	ic	cell	4		
	Function	· · · · · · · · · · · · · · · · · · ·		structure ar			•	.ic	CCII			
		gellates, Bioluminescence		Explore	10 1			lankt	onic			
		al clocks Ciliates, Diaton		flagellates,			_	agella				
				biolumines	cen			oiolog				
				clocks, cilia	ates, and diatoms.							
acidifica		of microorganisms in	7	Understand		the		ole	of	1, 2		
		ification, Marine microbes as a major		microorgan		IS	in	O	cean	4,	5	
_		ent of the Plankton, l		acidificatio			i.	o <b>h</b> oo	00.0			
sedimen		key role in the form		Recognize marine microbes as a major component of plankton,								
sediffen		ts		Explore how microbe								
					contribute							
					sediments.		-	-				
IV	Marine	virus: The nature of	6	Understand the nature of marine					1, 3	, 4		
viruses,		Viruses infecting pro		viruses,	in	cluc	ling	tl	nose			
Enumera		•		infecting prokaryotes;								
	particles	, Morphology of marine		Learn methods for enumerating				_				
					viruses and							
					and explor			iorph	olog	y of		
					marine viru	ises	•				1	

V	Exploring potentials of marine microorganisms, Bioactive Marine Natural Products, Bioactive compounds, biofilms.	7	Explore the potential of marine microorganisms, including the discovery and applications of bioactive marine natural products, bioactive compounds, and the role of marine microorganisms in biofilm formation.	1, 2, 3, 4,5
Practical	<ol> <li>Sampling techniques in marine microbiology</li> <li>Estimation of bacterial population from marine samples</li> <li>Isolation of marine actinobacteria</li> <li>Enumeration of total heterotrophic bacteria in sea water</li> <li>Hydrolytic enzyme profiling of the marine isolates.</li> </ol>	30	Master sampling techniques for marine microbiological studies. Accurately estimate bacterial populations from marine samples. Isolate and identify marine action bacteria. Enumerate total heterotrophic bacteria in seawater samples. Perform hydrolytic enzyme profiling of marine bacterial isolates.	1, 2, 3, 4,5, 6

- T1. Munn, C.B., 2019. Marine microbiology: ecology & applications. CRC Press.3rd edtn
- T2. Gasol, J.M. and Kirchman, D.L. eds., 2018. Microbial ecology of the oceans. John Wiley & Sons. 3rd edtn
- T3. Stal, L.J. and Cretoiu, M.S., 2016. The marine microbiome. Springer International: Switzerland.
- T4. Kim, S.K. ed., 2015. Springer handbook of marine biotechnology. Springer.

### **REFERENCE BOOKS:**

- R1. Mckane, L.and J.Kandel, 1996. Microbiology, Essentials and Applications. McGraw HillInc., New York, 843 pp
- R2. Austin B. an D.A. Austin, 1996 Bacterial Fish Pathogens- Diseases of Farmed and Wild Fish, Springer Praxis Publishing, 457 pp.
- R3. Stickney, B.R., 2000. Encyclopedia of Aquaculture. John Wiley & Sons, Inc, US. 1063pp.
- R4. Munn, C.B.2004. Microbial ecology: ecology and applications.BIOS Sci., Pub., US, 282pp. 7. Kirchman, D. L., 2008. Microbial ecology of the oceans John Wiley & sons US 593pp.

	CO PO Mapping				
S.N.	Course Outcome (CO)	Mapped Program Outcome			
1	Describe the distribution and significance of marine cyanobacteria and actinomycetes.	1, 4			
2	Explain the marine eukaryotic microbial cell structure and functions.	1, 3, 4			
3	Discuss the role of marine microorganisms in ocean acidification and sedimentation.	1, 3, 4			
4	Characterize marine viruses and virus-like particles.	1			
5	Explore the role of marine microorganisms in the production of various bioactive compounds	1, 2, 3, 4, 8, 9			