

Assam down town University

Curriculum and Syllabus

Bachelor of Science in Food, Nutrition and Dietetics

OUTCOME BASED EDUCATION FRAMEWORK

CHOICE BASED CREDIT SYSTEM

Version: 2.1

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 15th and 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

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 \mathbf{O} 10 Outstanding 9 Excellent A+8 Α Very Good 7 Good B+В 6 Above Average C 5 Average P 4 **Pass** F 0 Fail Abs 0 Absent 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 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.

Breakdown of Credits

Sl.	Category		Total number of
No			Credits
		Skill Enhancement Course (SEC)	5
		Ability Enhancement Course (AEC)	8
1	University Core (UC)	Field Training	0
		Discipline Specific Elective (DSE)	15
		Value Added Course (VAC)	2
2	University Elective (UE) Multidisciplinary Course (MDC)		2
2	Olliveisity Elective (OE)	Value Added Course (VAC)	4
		Discipline Specific Core (DSC)	54
3	Program Core (PC)	Field Training	3
3	Trogram Core (1 C)	Research /Industry Internship	14
		Summer Internship	3
4	Program Elective (PE)	Discipline Specific Elective (DSE)	17
_	1 Togram Elective (1 E)	Value Added Course (VAC)	4
5	Skill Enhancement Course (SEC		3
	1 dealty core (1 c)	Ability Enhancement Course (AEC)	0
	ı	Total	134

Breakdown by categories of courses

Sl no	Category	Credits	%
1	Science	125	93.28%
2	Paramedical	4	2.99%
3	Engineering	1	0.74%
4	Commerce and Management	4	2.99%
	Total	134	100%

SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course			Eng	gag	em	ent		Maximum Marks for			
	S. N.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23BSFD111R	Basics of Food Science	DSC - Major	3	0	2	0	0	0	4	50	50	100	200
	2	23BSFD112R	Basics of Human Physiology and Anatomy	DSC - Major	3	0	0	0	0	0	3	50	50	0	100
I	3	23BSFD113R	Human Nutrition	DSC - Major	2	0	0	0	0	0	2	50	50	0	100
	4	22UBPD113R	Elementary English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester	5	23BSFD114R	Field-based Learning and Community Services I	Field Training	0	0	0	0	0	6	1	0	0	100	100
9 2	6	23BSCE111R	MOOCS I	DSE	0	0	0	0	0	0	1	0	100	0	100
	7	23UBCC111R	Co-curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
	8	23UBEC111R	Extra-Curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
			DSC Minor (Sub D	isciplinary	7) (An	y o	ne	to t	e s	electe	ed)			
	9	23FSCH101R	Basic Chemistry	DSC- minor	2	0	0	0	0	0	2	50	50	0	100
		23FSZO101R	Cell Biology	DSC- minor	2	0	0	0	0	0	2	50	50	0	100
	Total				12	0	6	2	0	6	16				1000
	S.	Course Code	Course Title	Course			Eng	gag	em	ent		Max	imum N	Marks	for
	No.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23BSFD121R	Community Nutrition	DSC - Major	3	0	2	0	0	0	4	40	60	100	200
	2	23BSFD122R	Food Preservation	DSC - Major	3	0	2	0	0	0	4	40	60	100	200
П	3	23BSFD123R	Basic Dietetics	DSC - Major	3	0	2	0	0	0	4	40	60	0	100
mester II	4	23UBPD123R	Implicative English (Communicative English and soft skills)	AEC	0	0	4	0	0	0	2	40	60	0	100
Ser	5	23UBES101R	Environmental Science	MDC	2	0	0	0	0	0	2	0	0	100	100
	6	23BSFD124R	Field-based Learning and Community Services II	Field Training	0	0	0	0	0	6	1	0	0	0	0
	7	23BSCE121R	MOOCS II	DSE	0		0	0	0	0	1	0	0	0	100
	8	23UBCC121R	Co-curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
	9	23UBEC121R	Extra-Curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
	Total									19				1000	

	C N	C C- 1-	C T'41.	Course		F	ing	age	me	nt		Maximum Marks for				
	S. N.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total	
	1.	23BSFD211R	Food Microbiology	DSC - Major	3	0	2	0	0	0	4	50	50	100	200	
	2	23BSFD212R	Food Technology I	DSC - Major	3	0	2	0	0	0	4	50	50	100	200	
	3	23BSFD213R	Nutritional Biochemistry	DSC - Major	3	0	2	0	0	0	4	50	50	100	200	
	4	23UBPD213R	PDP (Proficient Communication)	AEC	0	0	4	0	0	0	2	0	0	100	100	
	5	22UUFL202R	Financial Literacy	SEC	0	0	4	0	0	0	2	0	0	100	100	
Semester III	6	22UULS202R	Basic Life-Saving Skills	SEC	2	0	0	0	0	0	2	50	50	0	100	
	7	23BSFD214R	Techno Professional Course I (Techniques of food preservation)	SEC	0	0	0	4	0	0	1	0	0	100	100	
	8	23BSFD215R	Field-based Learning and Community Services III	Field Training	0	0	0	0	0	4	1	0	0	100	100	
er	9	23BSFD216R	MOOCS (GE) I	DSE	0	0	0	0	0	1	1	0	100	0	100	
	10	23BSCE211R	MOOCS III	DSE	0	0	0	0	0	0	1	0	100	0	100	
	11	23UBCC221R	Co-curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100	
	12	23UBEC221R	Extra-Curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100	
	13	23BSFD217R	Additional Global Certification Course I (Advanced learner)	VAC	0	0	0	0	0	0	2	0	0	100	100	
			DSC Minor (Sub I	Disciplinar	y) (An	y oi	ie t	o b	e se	lecto	ed)				
	14	23FSCH201R	Natural Product Chemistry	DSC- Minor	3	0	0	0	0	0	3	50	50	0	100	
	14	23BSFD201R	Rural Sociology And Gender Inclusion In Agriculture	DSC- Minor	3	0	0	0	0	0	3	50	50	0	100	
	Total										26				1600	
		Total for advance learner									28				1700	

	S. N.	Course Code	Course Title	Course		I	Eng	age	me	nt		Maximum Marks for			
	5. IV.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23BSFD221R	Institutional Food	DSC -	2	0	0	0	0	0	2	50	50	00	100
	1.	23 D3 FD221K	service Management	Major	2	U	U	U	U	U	2	30	30	00	100
	2	23BSFD222R	Advance Dietetics	DSC - Major	3	0	2	0	0	0	4	50	50	0	100
	3	23BSFD223R	Nutrition through life Cycle	DSC - Major	2	0	0	0	0	0	2	50	50	0	100
	4	23BSFD224R	Food Technology II	DSC - Major	3	0	2	0	0	0	4	50	50	100	200
	5	23UBPD223R	PDP (Campus to Corporate)	AEC	0	0	4	0	0	0	2	0	0	100	100
	6	23BSFD225R	Techno professional Course II (Bakery Science)	SEC	0	0	0	4	0	0	1	0	0	100	100
Semester IV	7	23UULS201R	Basic Acclimatizing Skill	SEC	0	0	2	0	0	0	1	0	0	100	100
	8	23BSCE221R	Indian Heritage (Swayam)	VAC	1	0	0	0	0	0	1	0	100	0	100
ma	9	23BSFD226R	MOOCS(GE)-II	DSE	0	0	0	0	0	0	1	0	0	100	100
Š	10	23UUDL102R	Digital Literacy	SEC	0	0	2	0	0	0	1	0	0	100	100
	11	23UBCC221	Co-curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
	12	23UBEC 221	Extra-Curricular	VAC	0	0	0	2	0	0	0.5	0	0	100	100
	13	23BSFD226R	Additional Global Certification Course- II (for advanced learners)	VAC	0	0	0	0	0	0	2	0	0	100	100
	14	23BSFD227R	Additional Global Certification Course- III (for advanced learners)	VAC	0	0	0	0	0	0	2	0	0	100	100
			DSC Minor (Sub Disc	ciplinary) (A	ny	on	e to	be	sel	ect	ed)	•	•	•	
	15	23FSMB401R	Public Health and Hygiene	DSC minor	3	0	2	0	0	0	3	50	50	0	100
	13	23FSMB401R	Fermentation Technology	DSC minor	3	0	0	0	0	0	3	50	50	0	100
		Total									23				1400
		Total for adv								27				1600	

	S. N.	Corres Codo	Commo Title	Course		E	nga	age	mei	nt		Maximum Marks for				
	5. N.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total	
	1	23BSFD311R	Applied Nutrition I/	DSC -	3	0	2	0	0	0	4	50	50	100	200	
	1	AN & CN	Clinical Nutrition I	Major	J	Ü		Ü	U	U	т	30	30	100	200	
	2	23BSFD312R	Applied Nutrition II/	DSC -	3	0	2	0	0	0	4	50	50	100	200	
		AN & CN	Clinical Nutrition II	Major	J	Ü		Ü	U	U	т	30	30	100	200	
			Techno professional course													
			III (Diet Counselling/ Food													
	3	23BSFD313R	product development/	SEC	0	0	0	4	0	0	1	0	0	100	100	
			Community experience													
			learning)													
	4	23BSFD314R	Summer Internship	DSC -	0	0	2	4	0	8	3	0	0	100	100	
	7	23 D 314 R	(hospital/industry)	Major	0	٥	4	t	0	o	۲	O	U	100	100	
>	5	23BSFD315R	Research Project (mini	DSC -	0	0	0	0	12	0	2	0	0	100	100	
	3	23 D 31 D 313K	research)	Major)	0))	12	U	2	O	U	100	100	
ste	6	23BSFD316R	Research Methodology,	DSC -	2	0	2	0	0	0	2	50	50	100	200	
Je			bioethics and IPR	Major		,		·	,	U	2					
Semester	7	23BSCE311R	MOOCS IV	DSE	0	0	0	0	0	0	1	0	0	100	100	
S	8	23BSFD317R	MOOCS (GE) III	DSE	0	0	0	0	0	0	2	0	0	100	100	
	9	23BSFD318R	The Age of Sustainable	VAC	0	0	0	0	0	0	2	0	0	100	100	
		23D51 D316K	Development (Coursera)	VIIC	Ů	Ů	Ů	Ů	Ü	U	2	Ü	O	100	100	
			Additional Global													
	10	23BSFD319R	Certification Course IV (for	VAC	0	0	0	0	0	0	2	0	0	100	100	
			Advanced learners)													
			Additional Global													
	11	23BSFD320R	Certification Course V (for	VAC	0	0	0	0	0	0	2	0	0	100	100	
			Advanced learners)													
			DSC Minor (Sub Disc			on	e to	be be	sel	ecto						
	12		Herbal medicine	DSC minor	3	0	0	0	0	0	3	50	50	0	100	
	12	23FSFS501R	Functional food	DSC minor	3	0	0	0	0	0	3	50	50	0	100	
			Total								24				1300	
		For Ad	vance learner								28				1500	

	S. N.	Course Code	Course Title	Course		I	Eng	age	me	nt		Ma	ximun	n Mar	ks for
	S. IV.	Course Coue	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1	23BSFD321R	Internship	DSC -	0	0	0	24	0	0	6	50	50	100	200
			r	Major	Ĭ		Ĭ		Ĭ	Ĭ					
	2	23BSFD322R	Research Project Part II	DSC - Major	0	0	0	0	30	0	5	50	50	100	200
	3	23BSCE321R	MOOCs-IV	DSE	0	0	0	0	0	0	3	0	100	0	100
	4	23BSFD323R	MOOCS (GE) III	DSE	0	0	0	0	0	0	2	0	100	0	100
	5	23BSCE322R	MOOCS V	DSE	0	0	0	0	0	0	2	0	0	100	100
	6	23BSFD324R	AI in Healthcare Specialization (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
Semester VI	7	23BSFD325R	Additional global certification course VI (for advanced learners)	VAC	0	0	0	0	0	0	2	0	0	100	100
Seme	8	23BSFD326R	Additional global certification course VII (for advanced learners)	VAC	0	0	0	0	0	0	2	0	0	100	100
	9	23BSFD327R	Additional global certification course VIII (for advanced learners)	VAC	0	0	0	0	0	0	1	0	0	100	100
			DSC Minor (Sub Disc	ciplinary) (A	ny	tw	o to	be	sel	ect	ed)				
	10	23FSBO601R	Herbal Medicine	DSC minor	3	0	0	0	0	0	3	50	50	0	100
	11	23FSMB601R	Food Analysis	DSC minor	3	0	0	0	0	0	3	50	50	0	100
	12	23FSCH601R	Natural Product Chemistry	DSC minor	3	0	0	0	0	0	3	50	50	0	100
			tal								26				1000
		,	anced learners)								31				1300
		Total for all	six semesters								134				7300
	Total for all six semesters (For advanced learners)										149				8100

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

SEMESTER – I Course Title RASICS OF FOOD SCIENCE														
Course Titl	le	BASICS OF FOOD SCIENCE Total Credits: 4												
Course Cod	le 23BSFD111R		<u> </u>	L	T	P	S	R	O/F	C				
Duo Doguisi	to Nil	Total Hours: 45T+30	P	3	0	2	0	0	0	4				
Pre Requisi		Co-requisite	Food	NI4	miti o	- P-		Nil						
Programm Semester		Bachelor of Science in Food, Nutrition & Dietetics Fall/ I semester of first year of the programme												
Semester		1. To introduce the students the basics of nutrition.												
Course					det	aile								
Objectives	2	2. To study the basic food groups, cooking methods in details.3. To learn the new concept of food science.												
CO1		Discuss the fundamentals of food and nutrition and cooking methods.												
CO2		re, composition and nutr												
		onal aspect, selection, pro								ts and				
CO3	oilseeds and its tox		opuru	,	and	ч ррп	cumon	or pu	1505, 114	is und				
604		onal importance, storage	and co	ooki	ng te	echnic	ques a	nd cha	anges di	ıring				
CO4	cooking of vegetab						•			J				
CO5		Summarize the culinary role, nutritive value of sugar, fats and oil and the key processes												
COS	like caramelization	, hydrolysis and crystall	izatior	n										
Unit-No.	Con	Content						Outco	ome	KL				
	Food Groups: Definiti	Ho	ui	To	o mal	ce thei	n							
	-	ood Groups: Definition, classification of ood according to origin and functions,							erence					
	functions of food group				understand the deference between the groups of									
	foods, ICMR five food				od.									
		Iethods of Cooking: Objectives / reasons &				ookin	ig acti	vities	for	1,2				
	advantage of cooking,					-	confid							
	media, different cookin			ar	ıd ski	lls tha	t can							
	demerits of different co			pr	epare	them	for a							
	effect on nutrients				lif	etime	e of he	althy	habits					
	Cereals: Structure, con	*												
	value of cereals, storage		9)			-	ut cer	eals	1,2				
	cereals, Characteristics				ar	-,-								
	variety of preparations				\bot									
	Pulses, Nuts & Oilseed													
	composition, Selection variety of preparation,	• •			Т.	- 100m	n aboı	ıt tha						
	cost, effect of cooking a	-						ut the mposi	ition					
	value of pulses, nuts &	•	10	0				al fact		1,2				
	value of commonly use								nefits.					
	our diet, Highlighting s				"	1116	iica	001						
	constituents of pulses, I	•												
	Vegetables & Fruits-				+									
	composition & nutritive				Le	earnii	ng the	differ	ence					
	human nutrition, storag	-	8	3			-	etable						
	vegetables, changes in					_	enefit		1,2					
	on cooking, effects of h													
	Fats & Oils- Nutritive			Le	earnii	ng the	impor	tance						
\mathbf{v}	oils, role of fat in cooke	ery.	n)	of	fat &	z oil a	nd sug	gar in	1,2				
v	Sugar and Related Pr	9	9		diet and chemical									
	value, Properties, chara			re	actio	ns.								

	sugar cookery, Form of sugar and liquid sweetness, Caramelization, Hydrolysis, Crystallization.			
Practical	 Prepare a recipe from each food group Determination of hundred grain weight Determination of moisture content of legumes and oil seeds. Analyze the ph of different fruit juices by titration method Study about different extraction process of oils 	30	Learning and analyzing the importance of recipe from different food groups	1,2,3,4

TEXT BOOKS:

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	В									
Cour	se Code	23BSFD112R	Total Credits: 3 Total Hours: 45T	1 3	T 0	P 0	S 0	R	0/F 0	C 3	
Pre R	Requisite	NIL	Co-Requisite	3	U	U	NIL		U	3	
	rammes										
	mester Fall/ I semester of first year of the programme										
	-100001	1. To learn abou	it the anatomical positi						e of the o	gans	
Course Objectives and skeleton in the human body. 2. To assist students in developing a better grasp of the anatomical structure and bar physiological functions of various body regions. 3. Gain learn about the gross structure of different systems and bones in the body.						re and bas	C				
(CO1	Understand the structures of the	normal position, function body.	onal a	nd cross s	section	nal anat	omy of	various		
(CO2	Get a comprehe	nsive knowledge on cel	l, orga	ans and or	gan s	ystem a	and the	r function		
(CO3	Have insight known and blood coagu	owledge about the diffe	erent b	olood cells	s, diff	erent ty	pes of	blood gro	ıps	
	~~.	_	owledge on the gross s	tructu	re of dige	stive s	system.	respira	itory and		
(CO4	cardiovascular s					<i>J</i> ,	I	J		
(CO5	_	ve knowledge on the g	ross s	tructure o	f Mus	culo –	skeleta	l -system	and	
	-	bones in the bod	ly.		T						
Unit No.		Con	ntent		Contact Hour		Learni	ng Ou	tcome	KL	
I	• Level of Planes termin • Structure Transp Muscule • Bones: morph • Tissue • Cartila • Joints: joints.	re and Function of Organization — and Sections. Corology are and Function of Organization & Ort — Skeletal Systems Classification & Ology. and its types age definition, classifice and its types	Body Parts and Areas, mmon anatomical of Cell Membrane, Cell	ular	10	the a and cell To I Mus	nnatomi the bas and cel	ical terric function for the function of the f	basic of	1,2	
III organs of digestive system.						with	lent wil extens	sive kno	owledge	1,2	
IV	Respira	tory System- my of the respirate	ory tract		Students will understand and able to apply the knowledge of respiratory system						

	• 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
	regulation.		blood vessels with their	
	• Composition and functions of blood, Plasma, and		functions.	
	body fluids.			
	• Functions of RBC, WBC, and platelets			
	Hemoglobin.			
	Blood hemostasis			
	Blood groups			

TEXT BOOKS

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	Course Title HUMAN NUTRITION										
Course	Code	23BSFD113R	Total Credits: 2	L	T	I		R	O/F	C	
Course	Couc	23D3FD113R	Total Hours: 30T	2	0	0	0	0	0	2	
Pre Requisite Nil Co-Requisite Nil											
Progran	nmes	В	achelor of Science in	Food	l, Nutr	itio	n & Diet	etics			
Semes	ter		Fall/ I semester of fir	st ye	ar of t	he p	rogram	me			
Cour	'Se		tudents the basics of nu		•						
Object			functions, digestion, at	_				rients.			
			symptoms of different								
CO			terms related to nutrit			corre	elation w	ith hun	nan health		
CO2			tioning of nutrients in d								
CO3			of nutrients in terms of			ndit	ion.				
CO4		•	f disease and their treat								
COS	5	Analyze the sympton	ms of the deficiency dis	ease		. 1				1	
Unit-		Cont	tent		Conta		Lear	ning O	utcome	KL	
No.					Hou	r					
			th: Basic definitions,								
			tion of food according	το							
		ion and nutritive valu	e, physiological, inction of food, history								
		trition and importance									
I		_	111	8		Underst	and the	e relation	1,2		
1	-	ay today life. Recommended Dietary Allowances: Definition,					of food and health				
		gical value, bioavaila									
		nal Nutritional Requir	f								
	_	-	es- Reference Man and								
		rence women, factors									
			Assessment of Energy								
		irements, Deficiency					To unde				
**	_	ohydrates: Definitio			10		energy	1.0			
II	funct	ion. Digestion and ab	ex,	12		and	1,2				
	dieta	ry fiber and its import	ance, RDA, sources,				importa	nce of	СНО		
	metal	bolic disorder associa	ted with carbohydrate.								
	Prote	ein: Definition, classi	fication and function,				To unde	erstand	the		
III	Asses	ssment of protein qua	lity (BV, PER, NPU),		12		classific	cation,		1,2	
111	_	_	RDA, sources, disorders	3	12		compos			1,2	
		o deficiency or excess					require	nent of	protein		
		Definition, classificat	·				_		_		
	_	_	Types of fatty acids, rol				To unde		the		
IV			e (SFA, MUFA, PUFA	,	10		classific			1,2	
	_	ga-3). RDA, sources, o					compos				
		iency or excess, dieta	rt			requirer	nent of	tat			
	disea		ala Dia availabilita	1			Те т. 1	mata: 1	tha	-	
		•	ole, Bio-availability and ciency and excess (Fat				To unde		ıne		
	•	ole and water soluble)	icioncy and excess (Fat				compos		nd		
V		•	ole, bio-availability and		8		_		Vitamins	1,2	
▼		rements, sources, Def	·		O		_		nd learn	1,4	
	_		gnesium, Iron, Fluorid	ا ج							
		Iodine)		-,			the importance of water in healthy lifestyle.				
		·								<u> </u>	
Page	22		Curriculum and Sy	llabus	- 2023 - 2	.4, B.S	c in Food, N	utrition a	nd Dietetics – F	oS, AdtU	

Water: Distribution of water in the body, function		
of water, requirements and human water balance		
system, acid base balance		

TEXT BOOKS

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	23UBPD111R	Total credits: 2	L	T	P	S	R	O/F	C
Cour	se coue	250B1 D111K	Total hours: 30P	0	0	4	0	0	0	2
Pre R	equisite	Nil	Nil Co-requisite Nil							
Progr	Bachelor of Science in Food, Nutrition & Dietetics									
Sem	nester	Fall/ I semester of first year of the programme								
			nts to identify and use pa		speec	h, artic	eles, au	ıxiliary	verbs, and	1
Co	ourse		ative and negative senter							
	ectives		ced grammar concepts:						ers, constr	uct
ال ال			sentences, and understar		-	-	-			
			king skills: Enable stude							
		_	ntonation, and stress, and		-					
C	CO1		ecognize and apply part		peech,	article	es, and	auxilia	ary verbs, a	and to
			ative and negative senter							
C	O2		apply determiners, form	diffe	rent ty	pes of	senten	ces, an	d compreh	end
		degrees of compar								
C	03	_	confidently introduce the			_	_		ation,	
			ess, and effectively ask f							
~			p the communication pro							
C	O 4	• •	n formal and informal co	ommu	ınıcatı	on, and	l identi	ity bari	ners to effe	ective
		communication.	1	CC .	•			11 .	•	1 1
C	O 5		key components of an e	effecti	ive pre	sentatı	on and	i how t	o use visua	al aids
TT *4	1	proficiently.			44					1
Unit- No.		Conte	ent		ontact Hour]	Learn	ing Ou	tcome	KL
110.	Rocice	of Grammar (Flip	ned classroom)	1	1001					
		of Speech			Stud					
I	ii. Artic	•		6	a fu	1,2,				
_		liary Verbs			Ü		understanding of grammar			
		mative and Negativ	e Sentences			rule	s.			
		nar (Flipped classr								
	i. Deter	= =		G.			1 ,	vill con		
	ii. Sente	nce Construction					1,2,			
II	ііі. Туре	es of Sentences (Ass	sertive, Imperative,		6	_		-	orrect and	3,4
	etc.)					vari	ea sen	tence t	ypes.	
	iv. Degr	ree of Comparison								
	Sneaki	ng Skills							fidently	
	_	uction and Greeting	zs.						lves and	1,2,
III		inciation, Intonation			5		age in			3
		ng and offering info							th correct	
						proi	nuncia	tion.		
		unication Skills				Stud	dents v	vill effe	ectively	
117		uction to Communi			7			cate in 1	•	1,2,
IV		ess and Types of Co			7	forn	nal and	l inform	nal	3
		nal and informal con			setti	ings.				
		erstanding Barriers	to Communication							
	i. Introd	tation Skills				Stud	dents v	vill del	iver well-	
V			of a good presentation		8	orga	anized	and vis	sually	1,2
		of Visual Aids in Pr			supj	ported	presen	tations.		
	L	or visual Aius III Fl								<u> </u>
Page 24 Curriculum and Syllabus - 2023 - 24, B.Sc in Food, Nutrition and Dietetics - FoS, AdtU										

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	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	Course Title EXTRA-CURRICULAR ACTIVITIES										
Commo		23UBEC111R	Total anadita. (. =	L	T	P	S	R	O/F	C
Cours	se code	23UBEC111R Total credits: 0		J.5	0	0	0	2	0	0	0.5
Pre Re	equisite	Nil	Co-requisite			•		Nil			
Progr	rogramme Bachelor of Scien				Food	l, Nutri	tion &	Dietet	ics		
Sem	ester		Fall/ I semeste	er of fi	rst ye	ear of th	e pro	gramm	e		
	urse ctives	for state, nation 2. To enhance are drama, etc through	onal and international and international and improve student' ough AdtU club act Problem-Solving S	al leve s talen ivities	l com ts in t and v	petition the field vorksho	of spo	orts, yoş	ga, musi	ic, dance	2,
C	01		ship Skills-Students			_		•			
CO	02	Improve Social others.	Interaction-Students	s will l	learn	to intera	ct and	build r	elations	hips wit	h
CO	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 creatively and effectively.					lve prob	lems					
CO	D 5	Foster Cultural A	Awareness- Studentes.	s will	gain a	a better i	unders	tanding	and ap	preciation	on of
Unit- No.		Conte	nt	Con Ho			Lear	ning Oı	ıtcome		KL
I	particip co-curn the Un Swimn Tennis indoor Photog The stu in regul compel hobbie person.	iversity (Football ning; Basketball; athletics and oth games; Dance; Maraphy; Drama; Lindents are encourally club activities titions as per their s; Renowned skill alities are invited nops to promote the	orts, music, and oining the clubs of , Futsal; Cricket; Badminton; Table her outdoor and fusic; Vocals; iterary activities); aged to participate , workshops, r interest and led professionals/organising	6	0	their in active is sports, clubs, guidan	nterests partici music benefi ce and	develoes and ta pation is and co ting fro l engagi and com	lents the n diver o-curric m expended	rough se ular rt	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.	3,4,8							
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							

SEMESTER – I											
Course 7	Course Title BASIC CHEMISTRY									1	
Course c	code	23FSCH101R	Total credits: 2	L	T	P	S	R	O/F	C	
D D	• • •	NT*I	Total hours: 30T	2	0	0	0	0	0	2	
	Pre Requisite Nil Co-requisite Nil Programme Bachelor of Science in Food, Nutrition and Dietetics										
		В									
Semest	Semester Fall/ I semester of first year of the programme										
Course Objectives		 To give the knowledge about Chemical Kinetics and Ionic Equilibrium. To give a detailed description of atomic structure, different theories related to it and the knowledge of classical and quantum chemistry. To give the knowledge of the periodic properties and HSAB theory. 									
CO1		·	of the rate law equation lency of reaction rates						and		
CO2			of electrochemistry, e	_			_		H, buffers	and	
CO3		mechanics and Sch	ze atomic structure, H rodinger wave equation	on			ty prin	ciple,	Quantum		
CO4			of chemical bonding,	_							
CO5		Describe the difference molecules and their	ent types of organic restreechemistry.	eactions	along	g with th	neir me	echanis	sms. organi	ic	
Unit- No.		Conte	nt	Contac Hour	et	Lea	arning	g Outc	ome	KL	
I	First equa	mical Kinetics: Ord and second order, nation, temperature detions.	th order rate	5	a rottle rottle co	To identify the order (0, 1 or 2 associated with each integrate rate law equation, to describe the "half- life" of a chemical reaction. Understand the temperature dependence of rat of reactions through Arrheniu equation.				1,2	
п	Ionic equilibrium: Electrolytic conductance, Faraday's Law of electrolysis, Electrolytes, Lewis's theory, Arrhenius theory for dissociation of electrolytes, ionization constants of weak acids and bases, pH, buffers, solubility products, salt effects and Solubility			6	Describe, illustrate and explain the underlying concepts of electrochemistry, electrochemical cells, acids/base, pH, buffers and solubility					1,2	
III	Bohn beha deBri Unco appr Quar Schr vario orbit 3s, 3 repre vario	r's theory and its limitation of matter and rappelle's relation, Heisertainty principle. No oach to atomic structure mechanics, Timodinger equation and their variations and their variations and 3d orbitals. (Coesentation) Rules for our orbitals, electronatoms. Stability of harms and its limitation of the state of th	itations, dual adiation, senberg eed of a new ture. What is me independent d meaning of a functions (atomic ons for 1s, 2s, 2p, 2nly graphical filling electrons in ic configurations of	Describe, illustrate and explain the atomic structure, Heisenberg Uncertainty principle, Quantum mechanics and Schrodinger wave equation. To learn about the graphical representation of different atomic orbital and how the electrons are filled in the orbital.				ty echanics c out the on of al and	1,2		

	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 Title CELL BIOLOGY										
		Total credits: 2	L	T	P S R O/F					C
Course co	ode 23BSZO101R	Total hours: 30T	2	0	0	0	0	0		2
Pre Requi	site Nil	Co-requisite			1	Ni	l		l	
Programi	me I	Bachelor of Science in F	ood, I	Nutriti	on &	Dietet	ics			
Semeste	r	Fall/ I semester of first	t year	of the	prog	ramm	e			
Course Objectiv	of cytology incl cycle, cell division 2. To inculcate know structure by obse 3. Gain proficiency including microso	 Introduce and make students understand about the fundamentals and advances of cytology including structure and functions of cell and cell organelles, cell cycle, cell division, also by observing it under microscope. To inculcate knowledge and skills on various staining techniques, and understand cell structure by observing them under microscope Gain proficiency in laboratory techniques commonly used in cell biology research, including microscopy, cell culture, and molecular biology assays. 								
CO1		r organization, functions,								
CO2	transportation.	e structure, function, cell		izatior	and	the pro	teins	involve	d in	
CO3		omal structure and types.								
CO4		chanism of cell to cell co								
CO5	Describe the cell cy	cle and division in gener			ne sp	ecific c	ell typ	pes.		
Unit-No.	Con	tent		tact our	Learning Outcome				KL	
I	Fundamentals of Cell I Prokaryote and Eukaryot Function of cells); Tools Cytology: (Microscopy	te cell: Structure and and Technique of	,	7	Describe, illustrate and explain cell organization and functions, microscopy and structural differences.				n	1,2
II	Cell Membranes: Mode Cell junctions and adhes Membrane Proteins; Me Transport across plasma	ion; Transport proteins; mbrane potential;	1	Describe, illustrate and explain membrane structure, function; cell organization and the proteins involved in transportation.				1,2		
Ш	Chromosomes: Morphoorganization: nucleosom chromatid, centromere a (special type).	e, solenoid model, nd telomere); Types	1	.0	Describe, illustrate and explain chromosomal structure and types.					1,2
IV	Cell trafficking and sig signalling pathways; cell protein phosphorylation; phenomenon.	surface receptors,		8	Describe, illustrate and explain the mechanism of cell to cell communication				of	1,2
V	Cell Division & Cell Cy and differentiation; Over Germ cells, Cancer cells Necrotic cell death	eview of Stem cells,	1	.0	Describe, illustrate and explain the cell cycle and division in general and in some specific cell types				n	1,2

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-II												
Course Title COMMUNITY NUTRITION												
Course Code		23BSFD121R	Total Credits: 4	L	T	P	S	R	O/F	C		
			Total hours: 45T+30P	3	0	2		0	0	4		
Pre Requ		Nil	Co-Requisite					il				
Program			Sachelor of Science in Food	•								
Semest	er		pring/ II semester of first	•			ogramı	me				
Cours	e	1.To know about nutritional problems prevailing in India.										
Objectiv	ves	2.To impart nutrition education to the community.3.To understand and learn assessing nutritional status.										
CO1			critional problems revealing			riou	is comm	uniti	e in the	society		
COI			ritional status of people/gro							society		
CO2		assessment.	intional status of people/gre	ups	umou	511 U	irrerent	metn	ou 01			
CO3		***************************************	l evaluate nutrition interven	tion	nrogr	ams	to comb	at m	alnutriti	on .		
CO4		•	onal and international agence							JII		
CO5			assessing nutritional status		o upii	3	, matrice	Jilai 5				
	[Conta	ct	Le	arni	19			
Unit-No.		Co	ntent		Hou			utcon	_	KL		
	Nutri	ition and Health in Na	ational development.									
	Defii	Definition, IMR, NMR and MMR. RAP, nutritional										
I	statu	tatus assessment and surveillance.										
	Nutr	Nutritional Problems in India-Malnutrition-			10		Learning about nutrition, health and deficiency disorder					
	mean	meaning, factors contributing to malnutrition,								1,2		
1		vernutrition.								1,2		
		ntritional disorders-Epidemiology, clinical features,										
	_	vention and dietary treatment for Protein Energy										
		alnutrition, nutritional anaemias & vitamin										
		ficiency disorders.										
		hods of assessing nut										
			dentification of risk groups	'								
		Direct assessment-Diet surveys, anthropometric, clinical and biochemical estimation. Indirect assessment- Food balance sheet, ecological parameters and vital statistics.					Learnin					
II					9		various	meth	ods to	1,2		
11					,		assess t	he nu	tritional	1,2		
		wth chart	ina vitai statisties.				status					
		Meaning, WHO Chart, and charts used in India, uses,										
	meaning of reference curve and growth curve.											
			s-introduction, need, audio-									
	visua	al aids, teaching aids										
	Nutr	rition education- Me	aning, objectives, types and									
	meth	ods; Principles of pla	nning, execution and									
	evalu	ation of nutrition edu	acation program; Merits and	1			I earnin	o abo	art			
	limit	ations.						-				
III	-	rovement of nutritio	•		12					1,2		
		-	vement or nutritional				_		on			
	_						372					
	and h	ieaith, Antenatal and	postnatai care.									
Ш	Imita Impi Mode quali nutrie Nutri	rovement of nutrition ern methods of improsty of food, food fortifient supplementations.	n of a community: vement or nutritional fication, enrichment and . s and messages in nutrition		Learning about nutritional education to improve communication			1,2				

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	 Diet and nutrition surveys: Identification of vulnerable and risk groups. Diet survey for breast-feeding and weaning practices of specific groups. Use of anthropometric measurement in children. Preparation of visual aids. Field visit to observe the working of nutrition and health oriented programmes (survey based result). Visit to hospitals to observe nutritional deficiencies. 	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,

TEXT BOOKS:

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	tle	FOOD PRESI	ERVA	ΓΙΟ	N				
Course co	ode 23BSFD122R	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					Ni			
Programme Bachelor of Science in Food, Nutrition & Dietetics									
Semeste	Semester Spring/ II semester of first year of the programme								
	Course 1. To understand importance and need of preservation. 2. To understand principles and process of preservation.								
Objectives 2. To understand principles and process of preservation. 3. To understand different preservation methods.									
CO1	Learn and discuss	different preservation techn	iques a	nd n	nethods	in In	dia		
CO2	Provide knowledg	ge on principles and methods	of pre	serva	ation				
CO3	· · · · · · · · · · · · · · · · · · ·	canning methods and their ef	fects or	n the	nutritio	onal a	spect	s of food	l .
CO4		essing of Vegetables.							
CO5	Explain the fruit preserves, candies	processing methods, focusing	g on fru	it be	everages	s, jam	, jelly	y, marma	lade,
Unit-No.		ontent	Cont		Lea	rning	o Onf	come	KL
			Hou	ır					
_	=	ervation: History of Food	8					lerstand of food	
I	Preservation. Scope of	f Food and Vegetable			8		proces		
	Preservation in India.				Preservation				
	Principles and metho	ods of preservation: Food		To learn the different		erent			
II	Spoilage, Principles of preservation, Methods of			10		preservation method and			
	•	preservation: Pasteurization, sterilization,			its principal				1,2
	blanching, canning, di				r	- r			
		d vegetables: Canning:							
	selection of fruits and	ufacture, canning process,							
			To learn the different						
III	washing, peeling, cutting, blanching, cooling, filling, exhausting, sealing, processing, cooling and storage; types of canning pressure canning			process of preservation				1,2	
				applicable in fruits		ts and			
	and water bath cannin				vegeta	ıble			
	spoilage in canning of	foods.							
	Processing of vegetal	bles: Pickling, chutneys					_	essing	
IV	-	mushroom processing,	10		and de	_			1,2
1		ne other Valuable Products	10		preser	•	roduc	ct of	1,2
	from vegetables.				vegeta				
	_	Fruit Beverages, Jam, Jelly					_	essing	
V	and Marmalade, Prese		12		and de	_	men	101	1,2
	Crystallized Fruits, So Products from Fruits	ome omer varuable			preser produc		rnite		
	• Pickling of fruits an	d vegetables			produc	Ct OI I	ıuıts		
	• Pickling of meat and				Lagrni	ing or	ıd anı	olication	
VI	 Preparation of chutr 				of pro	-			1,2,3,4
Practical	• Preparation of Sauce	•	30		_		-	ifferent	,2,5,7
	• Preparation of jam a	-			food g				
	 Preparation of squas 	•							
		,							1

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				

C m	41.	SEMESTER -		CC							
Course Ti	tle	BASIC D			ъ	-		0.75	~		
Course co	de 23BSFD123R	Total credits: 4 Total hours: 45T+30P	L 3	T	P	S	R	O/F	C		
Due ne curie	site Nil		3	0	2	0	0	0	4		
Pre-requis		Co-requisite	Nil Food Nutrition & Distatics								
Programm Semester			Food, Nutrition & Dietetics								
Semester		Spring/ II semester of fi									
Course	-	 To study about different aspect of diet modification and adaptations. To study about the different nutrient modification at different disease state. 									
Objective	· · · · · · · · · · · · · · · · · · ·	ehensive understanding of							tions in		
Objective	_	_	uiet tiiera	ру (and the	Cruc	141 1010	e or aren	tialis III		
the healthcare industry CO1 Explain the concept of diet therapy and role of a dietician in health care indus				luetry							
CO2		spects of diet modification							+		
CO2		rtance of a hospital diet in f				weig	ni ma	nagemen	ι.		
CO4		edge of nutrition in diet mo				intoc	tinal t	ract discu	dore		
CO5	* * *	edge of nutrition in diet mo			_						
<u> </u>	Apply the knowle	age of nutrition in thet mo	Contac		i iivei a	ilia o	mary s	system p	looiciii		
Unit-No.	Co	ontent	Hour		Lea	rnin	g Out	come	KL		
	Concept of diet ther	apy: growth and source	Hour								
	of dietetics, purpose a	1.0									
	_	herapeutic diets, modification of normal et, classification of therapeutic diets, role of									
		et, classification of therapeutic diets, role of ietician, definition of nutritional care,									
		terpersonal relationship with patient,						1,2			
	_	anning and implementary dietary care.									
		futritional care process. Medical History			Learning about different						
I	_	ssessment. Assessment of patient needs.			concept of diet therapy						
		vietary counseling-Evaluation of the									
	1	fectiveness of counseling. Education of the									
	patient and follow up	•									
	Role of Dietitian–Pro										
	ethics of a dietitian. F										
	children at the hospita										
	feeding the patient.										
	Nutritional care for	weight management-									
	Obesity and overweig	ght: Identification,			Learn	ina o	hout				
II	etiology, dietary man	agement and	7		nutriti	-		or	1,2		
11	behavioural modifica	tions. Underweight:	,		weigh				1,2		
	Etiology, assessment	and dietary			weign	11101	iagein				
	management.										
	Nutritional care for				_	_					
III	Acute, chronic and re		7		Learn	_			1,2		
	Typhoid and TB–Etic	ology, symptoms and			nutriti	onal	care		,		
	dietary management.										
	Nutritional care for										
		t- Gastric and duodenal			Learn	ing a	bout				
IV		stipation, malabsorption	7		nutriti	-		or	1,2		
	syndrome, hemorrhoi				diseas	es					
	flatulence and steator										
V	symptoms and dietary	diseases of liver and	10		Lagree	inc -	hout		1.2		
V	muutuonai care tor	uiseases of liver and	10		Learn	шg a	บบนโ		1,2		

	biliary system- Viral hepatitis, cirrhosis of liver, cholelithiasis and cholecystitis: Etiology, symptoms and dietary management.		nutritional care for various clinical condition	
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			

				STER – I							
Course	e Title		1	RONMEN			,		T	T	
Course	e code	23UBES101R	Total cred Total hours		L 2	T 0	P 0	S 0	R	O/F	C
Pre-rec	muicita	Nil	Co-requi			U	U		<u>U </u>	0	2
Progra			Bachelor of Scie		od. Nu	ıtritio	n and				
Seme					of first year of the programme						
		1. To prepare stude								complex	
Cou Objec		2. To develop a wo	 To prepare students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective. 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 commitment to work individually and collectively towards solutions of current problems 								
		and prevention of	~	una conce	ouvery	towa	G 5 5 C	ration	or curr	ent proof	
		3. To gain knowled	ge about the con	servation o	of biod	liversi	ty and	d its ir	nportanc	e.	
CO) 1	The students will be	e able to appreci	ate the ethi	cal, cr	oss-cu	ıltura	l, and	historica	l context	of
CC)1	environmental issue									
CC)2	Students will learn			mport	ance a	ınd er	nviron	mental i	mpacts of	f
		Human activities or									
CC)3	Gain knowledge ab			stem,	Stude	nts w	ill be a	able to u	nderstand	l the
C C		concept of biodiver			1.	•.	1				
CC)4	Gain knowledge ab								an and	
CC)5	Aware students aborecosystem and cont	-	nvironnei	наг ро	iiutioi	1, 118 1	шрас	t on num	an and	
Unit-		Content		Contact	Learning Outcome					KL	
No.				Hour	East						
	Multic	lisciplinary nature		Environmental studies combines sciences to tackle environmental							
		nmental studies: D		issues. Its multidisciplinary approach							
I		portance, Need for p	4	is key to solving complex problems.						1,2	
	awarer			Public awareness and education are							
					vital for promoting sustainability				lity		
		al Resources: Rene									
		able resources, Nati									
		sociated problems. F									
		d over-exploitation,									
		se studies. Timber extraction, mining, ms and their effects on forest and tribal									
		. Water resources: U							th renew		
		tion of surface and g							ace expl		
		drought, conflicts o						-	prestation	1,	
**		penefits and problem							ources,	ī	1.0
II	resoure	ces: Use and exploita	ation,	6					nges wit	n	1,2
	enviro	nmental effects of ex	tracting and						nd land als play	2	
	_	mineral resources, ca			_				ving reso		
		esources: World food problems, changes							nability.	Jaroos	
		by agriculture and o	-			F	8				
		of modern agricultu									
	_	de problems, water l									
		udies. Energy resour needs, renewable ar	~								
		able energy sources,									
	TOHEW	ione energy sources,	use of affernate								

	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			
	Ecosystems: 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
111	characteristic features, structure and	4	ecological succession, and various	1,2
	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)			
	Biodiversity and its conservation:		This module covers biodiversity,	
	Introduction – Definition: genetic, species		including its definition, value,	
	and ecosystem diversity. Bio-geographical		levels, and threats. Students will	
	classification of India. Value of		learn about India's bio-geographical	
	biodiversity: consumptive use, productive		classification, its status as a	
IV	use, social, ethical, aesthetic and option	5	megadiversity nation, and key	1,2
	values. Biodiversity at global, National		biodiversity hotspots. They'll also	
	and local levels. India as a megadiversity		explore threats like habitat loss,	
	nation• Hot-sports of biodiversity. Threats		wildlife poaching, and human-	
	to biodiversity: habitat loss, poaching of		wildlife conflicts, crucial for	
	wildlife, man-wildlife conflicts.		conservation efforts.	
	Environmental Pollution: Definition			
	Cause, effects and control measures of:-			
	Air pollution, Water pollution, Soil			
	pollution, Marine pollution, Noise		This module covers environmental	
	pollution, Thermal pollution, Nuclear		pollution, including causes, effects,	
V	hazards. Solid waste, Management:	5	and control measures, alongside	1,2
	Causes, effects and control measures of	_	waste management and disaster	,
	urban and industrial wastes. Role of an		preparedness strategies.	
	individual in prevention of pollution.		r rr	
	Pollution case studies. Disaster			
	management: floods, earthquake,			
	cyclone and landslides.			
	Social Issues and the Environment:		This module explores social-	
	From Unsustainable to Sustainable		environmental dynamics, including	
	development. Urban problems related to		urban energy challenges, water	
VI	energy. Water conservation, rain water	6	conservation, and resettlement	1,2
	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 like	1,2
	Rights. Value Education. HIV/AIDS.		Family Welfare Programs and the	
	Women and Child Welfare. Role of		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. Study	5	pollution in urban or rural sites, and	1,2
	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				

			SEMESTEI	R – II							
Course	Title	IMPLICATIV	E ENGLISH (COMM	IUNICA'	TIVE	ENGI	LISH	& SOI	FT SKII	LLS))
Course	ahoo a	23UBPD123R	Total credits: 2	L	T	P	S	R	O/F		C
Course	coue	250B1 D125K	Total hours: 30P	0	0	4	0	0	0		2
Pre-req	uisite	Nil	Co-requisite				Nil				
Progra	mme]	Bachelor of Science in	Food, N	lutritio	on and	l Diet	etics			
Seme	ster		Spring/ II semester of	f first yea	ar of t	he pro	gram	me			
		1.To equip student	s with the skills to inte	rchange s	sentenc	e type	es, use	variou	ıs tenses,	and	l
			grammatical errors.								
Cou		2. To enable students to effectively use one-word substitutions, understand homonyms and									
Objec	tives	-	oid commonly confuse					_			
		•	understand the nature	and types	of list	ening	and c	vercoi	me barrie	ers to)
		effective listenin						11.00			
CO	1		rith the ability to transfer	orm sente	ence ty	pes, u	tilize (lifferei	nt tenses,	, and	1
)	rammatical mistakes.	1	1		1		1 ,		
GO	•	•	to proficiently apply o								1
CO	2	*	mophones, avoid frequ	ently con	irusea	words	, and 1	ncorpo	orate idio	ms a	and
		phrases in their voc	· · · · · · · · · · · · · · · · · · ·			1 4	of 1: a		ad :		
CO	3		comprehending the vari	•		• •	01 118	tening,	, and in		
			ercoming obstacles to e in employing effective			-	trootir	a rolo	vant info	rmot	tion
CO	4		lizing the SQ3R method		strateg.	ies, ex	uacui	ig relev	vani iiio	mai	поп
			n the significance of tir		rement	and n	rovide	found	lational		
CO	5		ge their time efficiently	_	cincin	and p	TOVIGO	Touric	iationai		
CO	6		reating a well-rounded		essiona	1 Link	edIn r	rofile			
Unit-				Contac							
CIIIC		Conte	4	Contac	Learning Outcome KI				77 T		
No.		Conto	ent	Hour		Lea	arnıng	g Outc	ome	1	NL
No.	Gran			Hour		Lea	arnınş	Gute	ome	+ '	NL
No.		nmar (flipped class	room)	Hour							KL
	i. Inte		room) ative and Assertive		St	udents	will a	nccurat transfo	ely		
No.	i. Inte	nmar (flipped class erchange of Interrog nces, Exclamatory a	room) ative and Assertive	Hour 6	St	udents nstruc	will a	iccurat	ely		1,2,
	i. Inte Sente Sente	nmar (flipped class erchange of Interrog nces, Exclamatory a	room) ative and Assertive		St co va	udents nstruc	will a	accurat transfo	ely		1,2,
	i. Inte Sente Sente ii. Ty	nmar (flipped class erchange of Interrog nces, Exclamatory a nces	room) ative and Assertive		St co va	udents nstruc	will a	accurat transfo	eely orm es and		1,2,
	i. Inte Sente Sente ii. Ty iii. Co	nmar (flipped class erchange of Interrog nces, Exclamatory a nces pes of Tenses	aroom) ative and Assertive and Assertive		St co va	udents nstruc	will a	accurat transfo	eely orm es and		1,2,
	i. Inte Sente Sente ii. Ty iii. Co Voca	nmar (flipped class erchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors	aroom) ative and Assertive and Assertive		St co va co	udents nstruc rious : rrect g	s will a t and t senten	accurat transfo ce type atical	eely orm es and	1	1,2,
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I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom	mmar (flipped class crchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Development word substitution onyms and Homophes often confused as and phrases	aroom) ative and Assertive and Assertive	6	St co va co	udents nstruc rious : rrect g	will a will a senten gramm	accurateransfoce type attical central	rely orm es and errors. e their vords	1	1,2,
I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom	mmar (flipped class erchange of Interrog nces, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph is often confused as and phrases ming Skills	aroom) ative and Assertive and Assertive	6	St coo	udents nstruc rious s rrect g udents ocabula curate	s will a t and t senten gramm s will e ary and	enhanc d use v	ely orm es and errors. e their words	1	1,2, 3
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I	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Lister i. Wh ii. Ty iii. U	mmar (flipped class crchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph is often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening inderstanding Listening	ative and Assertive and Assertive and Assertive and Assertive	6	St coo va coo St vo ac St eff. ide	udents nstruc rious s rrect g udents cabula curate udents fective entify	will a t and t senten gramm	enhance use voontext	eely orm es and errors. e their vords . strate ills and riers.	1	1,2, 3
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III	i. Intel Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Lister i. Wh ii. Ty iii. Ut Read i. Tec ii. Ga	mmar (flipped class crchange of Interrog nces, Exclamatory a nces pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph as often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening Skills chniques of Effective thering ideas and in	ative and Assertive and Assert	6	St co va co St vo ac St eff ide St an in:	udents nstruc rious s rrect g udents cabula curate udents fective entify udents d extr format	will a senten gramm will e will e ary and ly in control isteriact relaction us	enhanced use vontext lemons ting sking bar read effections	eely orm es and errors. e their vords . strate ills and riers.	1	1,2, 3
III	i. Inte Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Liste i. Wh ii. Ty iii. Un Read i. Tec ii. Ga iii. Th	mmar (flipped class crchange of Interrog nces, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph is often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening skills thiniques of Effective thering ideas and in the SQ3R Technique	ative and Assertive and Assert	6	St co va co St vo ac St eff ide St an in:	udents nstruc rious s rrect g udents cabula curate udents fective entify udents d extr	will a senten gramm will e will e ary and ly in control isteriact relaction us	enhanced use vontext lemons ting sking bar read effections	eely orm es and errors. e their vords strate ills and riers. ficiently	1	1,2, 3
III	i. Interest Sente Sente ii. Ty iii. Co Voca One v Homo Word Idiom Lister i. Wh ii. Ty iii. Ur Read i. Tec ii. Ga iii. Th Time	mmar (flipped class crchange of Interrog nces, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph is often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening Skills chniques of Effective thering ideas and in the SQ3R Technique -Management Skil	ative and Assertive and Assert	6	St co va co St vo ac St eff ide St an interest	udents nstruc rious s rrect g udents cabula curate udents fective entify udents d extra format chnique	will a senten gramm will e will e ary and ly in ce lister listeniact relaction us see.	enhanced use verontext demonstrated by the context demonst	tely orm es and errors. e their words strate ills and riers. ficiently e SQ3R	1	1,2, 3
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III	i. Interest Sente ii. Ty iii. Co Voca One v Homo Word Idiom Lister i. Wh ii. Ty iii. Ur Read i. Tec ii. Ga iii. Th Time i. Intrii. Pur	mmar (flipped class crchange of Interrog nces, Exclamatory ances pes of Tenses ommon Errors bulary Development word substitution onyms and Homoph is often confused as and phrases ming Skills at is listening? pes of Listening inderstanding Listening inderstanding Listening ideas and in the SQ3R Technique of Effective thering ideas and in the Effective	ative and Assertive are assertive and Assertive and Assertive and Assertive are assertive and Assert	6	St coo va coo St vo ac St eff ide St an intec	udents nstruc rious s rrect g udents cabula curate udents fective entify udents d extr. format chniqu	s will a t and t senten gramm s will control will control will react relation using their t	enhanced use voontext lemons ting sking bar read effectivitime us	e their words strate ills and riers. ficiently e SQ3R	1 1 1	1,2, 3 1,2, 3
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VI	Creation of LinkedIn Profile	6	Students will create a professional LinkedIn profile.	2, 3
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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		TIES				
Course	code	23UBCC121R	Total credits: 0.5	L 0	T 0	P 0	S 2	R	O/F 0	0.5
Pre-req	uisite	Nil	Co-requisite				Nil		1 -	
Progra	mme	Bach	elor of Science in Food	, Nuti	rition	and D	ietetic	s		
Semes	ster		ing/ II semester of first	-						
Cour	tives	 Develop students' interpersonal skills, emotional intelligence, and teamwork abilities through participation in diverse co-curricular activities. 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. To be aware of their role in society and contribute positively. Improve Interpersonal and Teamwork Skills- Students will learn to work well with others and communicate better. Develop Time Management and Organizational Skills - Students will learn to manage their 						lar		
time and stay organized. Boost Creativity and Critical Thinking - Students will enhance their think more critically. Promote Physical and Mental Health - Students will improve their oreduce stress. Encourage Social Responsibility and Civic Engagement - Students will be a students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility and Civic Engagement - Students or the courage Social Responsibility					overa	ll healt	th and	and		
Unit-			ociety and contribute pos	Cor	ıtact	Learning Outcome KL				
No.	Based on the learner's interest they can improving interpersonal and teamwork skills, developing time management and organizational skills, boosting creativity and critical thinking, promoting physical and mental health, and encouraging social responsibility and civic engagement. They will engage in regular club activities, workshops, and competitions that align with their interests and hobbies, fostering their social and emotional				our 60	Skill Enha as tea leade common critic Holis Supp socia devel acade Build Creat to interprofe Person Province expression as the common creating expression as the common creating profession and the common creating expression as the common creatin	Development of the property of	opmen skills s k, ation, a king. owth: emotic physicant along earning earning earning earning earning to portun with pead als. alfillment self-	t: uch nd onal, al gside s: ities ers, 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						

		SEMESTI	ER – III											
Course Ti	tle		MICROBI	OLO	GY									
C	1	Total credit	s: 4	L	T	P	S	R	O/F	C				
Course co	de 23BSFD214R	Total hours: 45	5T+30P	3	0	2	0	0	0	4				
Pre-requis	ite Nil	Co-requisi	ite		•		Ni	l						
Programn	ne l	Bachelor of Science	e in Food, l	Nutri	tion &	de Die	tetics							
Semester	·	Fall/ III semester of	f second ye	ar of	the p	rogra	amme	•						
Course	1. To know about m													
Objective	2. To know food co	•	•											
	3. To Acquire know	<u> </u>	ology, class	sificat	ion, a	nd ro	le vir	is and	l algae.					
CO1	Discuss the history													
CO2	Describe the role and													
CO3	Comprehend the morp								gy.					
CO4	Understand the occi							S.						
CO5	Acquire knowledge	of the morphology,	Contact	ion, ar	iu roi	e or a	igae.							
Unit-No.	Conte	nt	Hour		Lea	rnin	g Ou	tcome		KL				
	Introduction & Histor	ry of												
	Microbiology-The the	ory of												
I	Spontaneous generation	3	Learning about basic terms			ıs	1,2							
1		erminology, heterotrophic nutrition,			related to microbiology				1,2					
	autotrophic nutrition, s													
	holozoic, host culture,	_												
		acteria - morphology, reproduction, cowth curve, genera, importance in food			Learning about role of bacteria in food microbiology									
II	-													
	microbiology													
III	Fungi - Morphology, reclassification, physiological	-	7	Learning about role of Fungi in food microbiology			ngi in	1,2						
	Virus- Occurrence,	morphology,		Learning about role of virus in			us in							
IV	reproduction, classifica		5		l micr			01 111	45 111	1,2				
	Algae-Occurrence, mo													
	reproduction, importan			_		1 4		C 1						
V	principles of spoilage,	fitness & refines,	5		_			of alg	ae in	1,2				
	of food microorganism	s in food factors		food mic		ODIOI	ogy							
	affecting growth.													
	Study of equipments in	a microbiology												
	lab													
	Preparation of laborato	*		Lear	ning	about	eaui	oment	ts used					
	special media, cultivati	on of bacteria,			icrob		•							
***	yeasts and molds	,				_	-	aratio	n of	1,2,				
VI	Staining of bacteria: gr	~	30		_			acteria		3,4				
Practical	Cultivation and identification important molds and year.			mole	ds and	l yeas	sts in	food i	tems					
	Demonstration of avail							ods fo						
	methods and diagnostic	-		iden	tificat	tion o	of mic	roorga	anisms					
	identification of micro													
	products.	Ji Samonio of then												
	r-000000								<u> </u>					

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:

 $\underline{https://www.researchgate.net/publication/358954675\ introduction_history_and_development_of_microbiology}$

	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						

		SEMESTER – II	Ι											
Course Ti	tle	NUTRITIONAL B	SIOC	CHEM	IIST	RY								
Course co	ode 23BSFD213R	Total credits: 4		L	T	P	S	R	O/F	C				
		Total hours: 45T+30I	P	3	0	2	0	0	0	4				
Pre-requis		Co-requisite						il						
Programi			nelor of Science in Food, Nutrition & Dietetics											
Semeste		Fall/ III semester of secon												
		the different biochemical r							•					
Course		ow this metabolism takes p	lace	in co-	relat	ion v	vith t	he nu	trients o	f the				
Objective	food.				_									
	3. To assess fluid, e	electrolyte, and acid-base b	oalan	ice and	d to n	nake	info	med	clinical					
204		egies during imbalance												
CO1		netabolic reaction of the bo	•			1	· C'	. •						
CO2	= = :	ge of enzymes in terms of	then	r struc	ture,	clas	sifica	tion, j	properti	es and				
002	metabolic processe		1 ,	.1 .	, 1	1'		1	1' .1					
CO3	-	s classes of lipids and corre							_					
CO4		oility to assess fluid, electro nanagement strategies duri				vase	oarai	ice an	iu io ma	Ke				
						200	nd th	oir oc	anainta	1				
CO5	imbalances and dis	ance and clinical manifesta orders	ıtıOIl	9 OI II(л ШО	nes a	ınu ti	icii as	sociale(1				
	inioarances and dis	orders	Co	ntact										
Unit-No.	Cor	ntent		lour	I	Lear	ning	Outc	ome	KL				
	Carbohydrates-Defini	tion classification												
	_	tructure (linear) of Monosaccharide-Glucose,												
	· · ·	uctose and galactose; Disaccharides- Maltose,												
	~	actose and sucrose; Polysaccharides-Starch and			Learning about the structure and function of carbohydrates				e					
I		lycogen. Metabolism-Glycolytic pathway,							1,2					
		ectron transport chain and oxidative												
	_	nosphorylation. Metabolism of carbohydrates:												
	glycolysis and tricarbox	ycolysis and tricarboxylic acid (TCA) cycle,												
	HMP shunt.													
	Protein- Definition, cla	assification, structure,												
	physical properties, che	emical properties and												
	utilization. Metabolism	•												
		nation, decarboxylation,												
	urea cycle. Enzymes ar	*					_	out th						
II	Definition, types, class			10				l func	tion of	1,2				
	affecting velocity of en	•			pro	otein	S							
		alue of serum enzymes -												
		aline phosphatase, Acid												
	phosphatase, LDH, SG	*												
	Lipids Definition class													
	Lipids- Definition, clas	SITICATION AND			I a	orni-	va ob	3114 4L	0					
III	properties. Metabolism- Oxidation	and hipsynthesis of		10			-	out the	e tion of	1 2				
1111	Metabolism- Oxidation and biosynthesis of fatty acids. Ketone bodies, ketogenesis and			10			c all(ııulic	HOH OI	1,2				
	ketosis.			lipids										
		cid – base balance- Acid-base balance in					+ +							
		nition of buffers,			Ie	arnir	าด ลh	out th	e role					
IV	principles of buffers, m			13			-			1,2				
		-							, 000					
	principles of buffers, in produced in the body, p	-			01	of fluids and electrolytes								

	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	tle	FOOD TECH				T	1	T -	ı	
Course co	ode 23BSFD212R	Total credits: 4	L	T	P	S	R	O/F	C	
D •	• A TOT	Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-requis		Co-requisite	N.T	4 • 4 •	0.1		Nil			
Program		Bachelor of Science Food	-							
Semeste		Fall/ III semester of second processing of cereals, pulses,						lag magt	ata	
Course				eus, i	ruits	and ve	getabl	es, meat	etc.	
Objective	29	2. To know about preservation of various foods.3. To learn about post-mortem changes in meat and various preservation methods.								
CO1		ocessing technology and com			•					
CO2	_	sing technology and composi	_							
CO3	* *	e about the processing and qu		_				ils.		
CO4		assification and post-harvest of								
CO5		nortem changes in meat and v								
		-		ntact						
Unit-No.	C	Content	I	Iour	L	<i>e</i> arni	ng Ou	tcome	KL	
	Cereal & Millets: Pro	•								
	_	by-products of cereals and								
		of malting, Gelatinization								
	of starch, types of brow				earning					
I	rice obtained by different dehusking methods,			9	str	1,2				
		nilling of rice, by-products of rice milling, Processing-Milling, polishing, parboiling, flaking,				processing of cereals and millets				
		arching, roasting. Millets-Varieties, composition			and mine		eis			
		nd uses of maize, sorghum, barley, rye, oats,								
	_	iticale, pearl millet and finger millet.								
	Pulses & Legumes: M									
	processing of pulses-so									
		and fermentation. Toxic			Le	earning				
II	constituents in pulses a	nd its detoxification		10	str	ucture	e, use a	ınd	1,2	
11	processes. New improv	ved technologies of legume	processing of pulses							
	processing- canning, q	rocessing- canning, quick cooking legumes,			and legumes					
	instant legume powder	nstant legume powder, legume protein								
	concentrates									
		ds of oil extraction, refining								
	of oil, types- steam ref	-			Le	earning	g abou	t		
777	-	lorization, hydrogenation,		12	pre	ocessi	ng and	1	1.2	
III	winterization, randomi	zation/ ncidity - hydrolytic and		13	qu	ality a	ttribut	es of	1,2	
		its prevention. Define -			fat	ts and	oils			
	_	ogenated vegetable oil, lard.								
	Fruits and Vegetable									
	Classification of fruits and vegetables, general									
		composition, enzymatic browning, names and					1			
	sources of pigments, P				_	g abou				
IV	and vegetables - Clima	teric rise, horticultural		10	_	-	ttribut proces	es, ssing of	1,2	
		maturity, physiological					_	tables		
		ges, chemical changes,			111	ario all'	a vege	autes		
		uring the storage of fruits	ts							
	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	FESSIONAL COURSE	I (TE	ECHN	IQUES	OF I	PRESE	RVATIO	N)	
Course	ahoo	23BSFD214R	Total credits: 1	L	T	P	S	R	O/F	C	
Course	coue	23DSF D214K	Total Cicatos 1		0	0	4	0	0	1	
Pre-requ	uisite	Nil	Co-requisite				N				
Prograi	mme]	Bachelor of Science in	Food,	Nutri	ition &	Diete	tics			
Semes	ter		Fall/ III semester of second year of the programme III								
Cour	ese.		ortance and need of pre-								
Object		•	nciples and process of pr		tion.						
_			erent preservation method								
CO		• •	th practical knowledge a							ods.	
CO2		-	standing of the principle						echniques.		
CO3			ety and hygiene practice								
	CO4 To promote the utilization of locally available resources for food preservation.										
COS	5	To foster entreprener	urial skills related to foo	•		on.					
Unit- No.		Conte	ent	Con Ho		L	earnin	g Outo	come	KL	
- 100	Hand	s-on training in vario	us preservation			To lear	n and	underst	and the		
I		iques.	F	8		chronology of food processing					
		tional Preservation M			and preservation						
	Demo	onstration and practic	e of food hygiene and			To lear					
II		y practices	e of food hygiene and	preservation method an principal				and its	1,2		
	Prens	aration of preserved for	ood products. Pickling,								
	•	eys and Sauces/ketch							t process		
III		essing, potato processi	•	12		_			cable in	1,2	
Valuable Products from vegetables.					fruits a	nd veg	etable				
						To lear	n the c	levelop	ment and		
IV	Packa	aging and labeling of	preserved products	10	0	labeling	g of pr	eserve	d product	1,2	
						of vegetable					
V	Mocl	y food stalls and mark	et cimulations	1	,	To lear	n the t	echniqu	ues of	1,2	
V Moc		ock food stalls and market simulations		1	_	selling the products in market					

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								
Course	e Title	E	NGLISH LANGU					1	1	1	
Course	e code	23UBPD212R	Total credits: 2		T	P	S	R	O/F	C	
Pre-rec	micito	Nil	Total hours: 60 Co-requisite	P 0	0	4	0 Nil	0	0	2	
Progra	-		helor of Science in	Food N	utrition	and D		20			
Seme			l/ III semester of s								
Scine	1 To understand and apply grammar r					c progr	amm				
Cou			2. To develop clear and structured writing skills.								
Objec	etives	3. To cultivate self-management skills.									
	\	Enable students to use		truct sim	ole, com	plex, ar	nd con	npound	sentenc	es,	
CC)1	and distinguish betwe		-				•			
CC	\2	Teach students the base	sics of writing, how	to avoid	ambigu	ity, wri	te para	graphs	s and lett	ers,	
CC)	and prepare resumes a	and cover letters.								
CC)3	Help students conduct	SWOT analyses, p	ractice se	lf-regul	ation, a	nd ma	intain _J	personal		
	<i>,</i>	hygiene.									
CC)4	Equip students with k	nowledge about nor	n-verbal o	commun	ication,	, types	of bod	ly langua	age,	
		and their impact.									
CC)5	Train students in plan		g group d	iscussio	ns, effe	ctively	y disag	reeing, a	ınd	
			ummarizing to attain objectives.								
CC) 6	Prepare students for personal interviews, answer common interview questions, follow telephone interview etiquettes, and adhere to dress code and grooming standards.									
Unit-		telephone interview e	iquettes, and adner	Contact	_	iu grooi	illing s	tanuar	us.	T	
No.		Content		Hour	,	Leari	ning O	utcom	ne	KL	
	Gram	mar (Flinnad classro	m)		Students will correctly use						
		Grammar (Flipped classroom) i. Use of Prepositions ii. Simple, complex, compound sentences			prepositions, create various sentence structures, and convert						
I						sentence structures, and convert					
		ctive and Passive Voice			en acti	ve and	l passiv	/e			
	XX7 *4*	CI II		voice		<u> </u>					
		ng Skills e Basics of Writing; avo	oid ambiguity and								
		•	old alliviguity and		Students will write clear and						
II	_	vagueness Paragraph Writing								3, 4	
		ter Writing			resun	nes, and	l cover	letters	S.		
		sume and Cover Letter									
	Self-N	Management Skills			Stude	nts will	l perfo	rm SW	/OT		
III	i. SW	OT Analysis		5	analy	ses, sel	f-regul	late, an	ıd	2 1	
1111	ii. Sel	f-Regulation		5	adher	e to per	rsonal	hygien	ie	3, 4	
		rsonal Hygiene			practi	ces.					
		Verbal Communication	on-Sciences of								
		Language				nts will					
IV		at is Non-Verbal Comn	nunication & Body	5		-		erent ty	ypes of	2, 3	
	_	Language			_	langua	_			, -	
		ii. Types of Body Language,iii. Importance and Impact of Body Language,			communication.						
			bouy Language,		Ctual	nte vill	l nlon	and		1	
	·	p Discussion nning and Elements of G	Group Discussion			nts will ipate in	•		ecione		
\mathbf{V}	1	ectively disagreeing,	210up Discussion	5	_	_	-			3, 4	
		mmarizing and Attaining	ng the Objective.		disagree constructively, and summarize discussions.						
	111. Du	minuizing and Attailin	ng the Objective.	summarize discussions.							

- 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 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								
Cours	e Title		BASIC LIFE								
Cours	se code	23UULS202R	Total credits:		L	T	P	S	R	O/F	C
		27/1	Total hours: 30		2	0	0	0	0	0	2
	quisite	Nil Co-requisite Nil Bachelor of Science in Food, Nutrition and Dietetics									
	ramme										
Sem	ester		Fall/ III semester o		•					4!1	<u> </u>
Course Objectives		 The aim of the conskills needed in a To provide approximate 3. To learn about the alive. 	n emergency fire s opriate basic manag	situati geme	ion. nt and	treatmer	nt for i	njuries	•		
C	01	The students will b to the patients to su	_	_	iratory	arrest/ c	cardia	e arrest,	and p	rovide o	xygen
CO	D2	The students will b infants victims	e able to perform tl	he im	portan	ce of ea	rly CF	PR on A	dult, c	hild and	[
CC		The students will b pain and protecting	the victims from d	-	_	_	orse,	aiding r	recovei	ry, reliev	ving
CO		Importance of phys The students will b operation and getting	e able to learn abou	ut the	fire ed	quipmen	ts req	uiremer	nts, me	thods of	f
Unit- No.		Content			ntact our		Learn	ing Ou	itcome		KL
I	• Introd • Chair • ABC • CPR • AED	To acquire the knowledge a skills necessary to effective perform cardiopulmonary resuscitation (CPR), use an automated external defibrill (AED), and manage choking for adult and children To acquire the knowledge a skills necessary to effective perform cardiopulmonary resuscitation (CPR), use an automated external defibrill (AED), and manage choking emergencies in adults and children within the context of chain of survival.				ely n llator ng	1,2				
П		aid en rules of First aid aid Kits			5	Golden the app	Rule ropria	d and a s of First te use of gency si	st Aid of First	and t Aid	1,2
III	• Introd • Priori hospita • Scene • Prima • Bleed • Extric • Cervic applica • Splin	ities of Initial approaul care e safety ary assessment ling control cation of victims and cal spine stabilization ation ting of broken Limbs	safe transfer and C-collar		5	To understand and apply principles of initial traum including scene safety, p assessment, bleeding con extrication techniques, compared spine stabilization, and so of broken limbs, in pre-hemorgency situations.			rauma ty, pring g contress, cer and spl pre-hos	care, mary rol, vical inting spital	1,2
IV	Triage system • Introduction • Flow chart approach of Triage • Triage of Single and Multiple Casualties To understand the princip Triage, including its intro flowchart-based approach application in assessing a				introd roach,	luction, and its	1,2				

	in Pre-Hospital setting		prioritizing treatment for both single and multiple casualties in pre-hospital 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	 Safety of people in the event of fire Recognition of possible fire sources and emergency procedures, Construction techniques for eliminating fire. Types of detecting devices and extinguishing agents and systems Devising procedures in the event of fire and react to fire danger. Safety goals and objectives, Identifying hazards and risks 	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								
Course	Title		PERSONAL FI								
Course	e code	23UUFL202R	Total credits: 2	L	T	P	S	R	O/F	<u>C</u>	
Pre-rec	misita	Nil	Total hours: 30P Co-requisite	0	0	2	0 Nil	0	0	2	
Progra	_		achelor of Science in	Food, N	utritio	n and		tics			
Seme			all/ III semester of se								
			offer an inclusive app				_		oncepts of	•	
		money, borrowing, lending, taxes and their application to financial planning.									
Cou	rse	2. Assess the personal financial planning process, the life cycle of financial plans, and									
Objec	etives	methods of goal ac									
			et, record-keeping syst	tem, and t	tax pla	nning	strateg	y base	d on curre	ent	
		financial goals									
CC)1	_	agement strategy and	a plan to	facilita	ate the	home	or auto	omobile b	uying	
		process Design a diversified	investment portfolio t	that added	ACCOC C	ovoro1	difform	nt inv	setmont		
CO	2	objectives.	mvesument portiono (mat addre	sses s	everal	umere	iii iiive	sunent		
			en open- and closed-en	nd mutual	funds	, exch	ange-tr	aded fi	unds, and	direct	
CO)3	or indirect real estate	-			,			, and		
	.		an that covers your in	come nee	ds in r	etiren	nent and	d helps	protect y	ou	
CO	74	and your estate.									
CO)5		record-keeping syster	m, and tax	k planr	ning st	rategy	based	on curren	t	
	1	financial goals	1							1	
Unit- No.		Conten	t	Contact Hour		Lea	rning (Outcor	me	KL	
		amentals of Financia	al Planning –						amental		
		ctions of money;			concepts of finance, including						
		ation- Meaning, caus	es, how it can be		the functions of money, the						
	contro	onea; ocess official planning	•		impact of inflation, the principles of financial planning,						
I	_	ne value of money-si		6	the time value of money (simple and compound interest, NPV,						
		ound interest;	imple and								
	•	Present Value and Fu	uture value,		and future value), the power of						
		wer of Compounding	•		compounding, and the doubling						
		oubling period and Ru				_	d Rule				
	Incor	ne Tax Planning–							epts of		
		ning of Income,			income, direct and indirect						
		ect & Indirect Taxes,	Taxable Income,			-			taxable		
II		s heads of Income for		6			xplore			1,2	
		n-taxable Income,	·				ance, a				
		x evasion and tax avo	idance,			-	ious tax	_	ıng		
	v. GS'	Γ, Tax Planning Strat		strategies within the framework of GST.							
	Entre	preneurial planning	-				stand th		ept of		
							eurship		.r. 32		
		i. Meaning of Entrepreneurship, prerequisites for becoming an entrepreneur,				_	ites, an		alyze		
III		repreneurship Suppor		6	_	_			•	1,2	
	iii. Institutional support systems for			the various support systems available in India, including					1		
		titutional support sys	tems for		avai	ilable	in India	a, inclu	ıding		
	iii. Ins	titutional support sys reneurs, ancial support systen			gov	ernme	in India ent assis instituti	stance,			

	entrepreneurs;		capital, and angel investors, for	
	v. Venture Capital, Business Angels,		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 of NSE, BSE DEMAT trading account, iii. Security repository, stock brokers, Operational aspects of securities markets:		To understand and evaluate investment avenues in the securities market, including	
IV	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	stock markets, mutual funds, and their operational aspects, while identifying and mitigating associated risks through knowledge of financial intermediaries and investment strategies like SIP.	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	To develop a comprehensive understanding of financial planning principles, including consumer credit management, housing and vehicle financing, retirement planning strategies (including need analysis, investment options, and retirement schemes), and estate planning considerations (including pension, Medicare, and wills).	1,2

	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 – I	II .						
Course 7	Γitle	RURAL S	OCIOLOGY AND GENDE	R IN	CLUS	ION I	N AG	RICU	LTURE	1
Course	ode	23BSFD201R	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	1 37			Nil	,		
Progran			Bachelor of Science in Fo							
Semest	er	1.70 1 .1 .1	Fall/ III semester of secon						1	
			ntricate relationship between	rural so	ocietie	s, genc	ier dyi	namic	s, and	
Course		agricultural pr		1 foot	ora that	- chono	. mumo 1	aamn	nunitios	with a
Cours Objecti		-	social, economic, and culturals on gender roles, inequalitie			_		COIIII	iumnes,	willi a
Objecti	ves	-	the impact of government po		_			roorar	ne on rui	•a1
			particularly women farmers.	iicics (and de	velopii	nent pi	ograi	iis Oii Tui	aı
			complex social structures and	institu	tions i	n rural	areas	incl	ıding	
CO1			kinship systems.	IIIStitu	tions i	ii i ai ai	ur cus,	, inicio	iding	
			itional and evolving gender re	oles an	d relat	ions in	rural	socie	ties.	
CO2		particularly in ag	~ ~	, , , , , , , , , , , , , , , , , , ,		10110 11		55515	,	
		• •	cally examine the gender-bas	ed ine	qualiti	es prev	alent	in		
CO3		rural areas, including access to resources, decision-making power, and								
		opportunities.								
004			rural development theories a	nd pra	ctices,	with a	focus	on ge	ender-sei	nsitive
CO4		approaches.	-	-						
CO5	Assess the impac	ct of government policies and	devel	opmen	t progr	ams o	n rura	ıl commu	ınities,	
COS		particularly won	nen farmers.							
Unit-		,	Content		ntact	Le	arnin	σ Om	tcome	KL
No.				H	lour					112
_			sociology: Definition and				earn ab			1,2
I	_	pe, its significance in agriculture extension,			10	<i>C</i> ,				
		al society.	1.0 1.0 1.0 1			socio		~		
		-	1 Stratification, Culture		To le				ocial	1.0
II		-	tion, Social Change &		7		ips, So			1,2
		elopment	nal Status of Women in				ificatio		1 1/1.	
							iscuss Nutriti		health	
III	_	-	Causes for Poor Health and cong Rural Women, Effects of		10		omen		Status	1,2
		r Health & Nutriti					omen culture			
			in Agriculture & Allied			Agn	Cultule	-		
			en in Crop production, Post			To di	iscuss	ahout	the	
			* *						nen in	
IV		arvesting, Livestock, Fisheries, Forestry					culture			1,2
		ome management, Rural Production and				_		ω 11	iiica	
	1000	Food Security Sectors								
	Stat	us Of Women in	Rural Families: Measures to)		To di	iscuss	about	the	+
v			d economic status of rural		8		s of W			1,2
·	won				-	Rural Families			-,-	
L		WOIIICII								

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 ACTI	VITII	ES					
Course c	ode	23UBCC211R	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	7 NT / */	•		Nil				
Program			Bachelor of Science in Foo					-			
Semest	er			ond year of the programme							
Cours Objectiv		through participa 2. Foster leadership students to take	 Develop students' interpersonal skills, emotional intelligence, and teamwork abilities through participation in diverse co-curricular activities. 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. 								
CO1		Improve Interperso	onal and Teamwork Skills- better. nagement and Organization	Students v	will lea						
CO3		think more criticall	nd Critical Thinking - Studo y. and Mental Health - Studen							and	
CO4		reduce stress.									
CO5		_	Responsibility and Civic En in society and contribute p		t - Stuc	dents	will b	ecom	e more		
Unit- No.		Cor	ntent	Contact Hour]]	Learn	ing C	Outco	me	KL	
I	impledeve skill prore encorenga activalign their Ren to er inches well man crea	eloping time manageds, boosting creativity moting physical and puraging social responsement. They will exities, workshops, are with their interests a social and emotion owned professionals inhance students' tale and participation in a sys, journals, and evalute experiences, studed with others, communage their time, stay attivity, think criticallate stress, and contri	and teamwork skills, ement and organizational y and critical thinking, mental health, and onsibility and civic engage in regular club and competitions that and hobbies, fostering al development. It is will conduct workshops ents. Assessments will activities, reflection aduations of their apps and events. Through this will learn to work unicate effectively, organized, enhance y, improve their health,	60	deve culti- team man orga nurt criti- sens resp enga acti- men	cal thise of soonsiba	ent by g inte g, time ent, a creati inking ocial ility ti extrace work ip from	y rperso e nd skills vity, g, and hroug curric shops m	, while I a gh cular s, 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				

Correct	T;41.	TAICH	SEMESTER		VICE	МАХ	IACT	MENT			
Course	1 itie	INSI	TITUTIONAL FOOD						0/5		
Course	code	23BSFD211R	Total credits: 2	L	T				O/F	C	
Duo noo	nicito	Nii	Total hours: 30T	2	0	U			U	2	
Pre-req		Nil Co-requisite Nil									
Program		Bachelor of Science in Food, Nutrition & Dietetics									
Semester Spring/ IV semester of second year of the programme											
Cour		 To introduce with catering industry and food service system. To know about principles, tools and techniques of management. 									
Object	ives	2. To know about principles, tools and techniques of management. 3. To apply the knowledge of financial and personnel management in a food service unit									
CO	1			•							
		Classify the food service system its components, and assess their functions. Acquire knowledge of floor planning, layout characteristics, and equipment necessary for									
CO	2	food service facilities				,		r		,	
CO.	3	Develop a menu plan and learn to standardize different recipes.									
CO	1	Explain the food servi	ice management syster	m							
CO	5		of financial and perso		nanage	ement	in a fo	od serv	ice unit		
Unit-		C4	4	Conta	ct	т		04-		KL	
No.		Conten	t	Hou	r	L	earnii	ig Outc	ome	K	
	Cate	ering industry-Definit	ion of catering.								
	Clas	sification of food servi	ce institutions								
	acco	ording to									
	a. Fu	unction: Profit oriented	, service oriented								
I		public health facility or					-	ut funct	_	1,	
•		ocessing method: Conv	9	C	of food	servi	ce institu	itions	1,		
		missary system and fas									
	syste										
		rice of food: Self service									
		er-waitress service.									
		or planning and layou									
	-	pical food service facil									
		of work areas-Receivi									
		aration, cooking, servi			I	Learnii	ng abo	ut divis	ion and		
II		washing, pot and pan w	-	10	d	listribu	ition (of worki	ng areas		
	_	age disposal: flow spac	_	10	i	n food	servi	ce instit	utions		
		king heights and dimer	ISIOIIS OF WOLK								
	cente	ipment–Classification,	factors involved in								
	_	ction, use and care of m									
		ntity food preparation									
		hasing methods and sto									
	_	u planning – Definition	-								
		lved in planning and ty									
III		dardization of recipe –	_				-	ut menu		1,	
		dard recipe format and		13	p	planning and quality control					
		dard portion sizes-Defi									
		pments and portion cor	~								
		foods									
	Mar	nagement-Definition, p	orinciples and				1	4			
TX 7		niques of effective man	_				-	out runni	-	1 1	
IV	Tool	ls of management-Orga	nization chart,	10	food institution in an					1,2	
	worl	study and work impro	ovement.			organized manner					

	Use of computers in food service establishments.			
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			

			SEMESTER	IV									
Course T	Course Title ADVANCE DIETETICS												
Course code		23BSFD222R	Total credits: 4	L	T	P	S	R	O/F	C			
<u> </u>			Total hours: 45T+30	P 3	0	2	0	0	0	4			
Pre-requisite		Nil	Co-requisite		. •		Ni						
Program			Bachelor of Science in										
Semest	er		Spring/ IV semester of second year of the programme										
Course Objectives		To study about different metabolic and systemic diseases and nutrient drug interactions. To study about the different nutrient modification at different disease state.											
		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											
CO1		of the relationship of dietician with health and develop skills required in Nutritional											
		counseling											
CO2		Learn and apply ac	laptation of therapeutic of	liets in dif	ferent	disea	se sta	te					
CO3		Acquired knowled	ge on nutritional manage	ement in ir	nfection	ons an	d feve	er					
CO4			nce of therapeutic diet in										
CO5		_	icance in the modification		in ga	stroin	testina	ıl diseas	es.				
		Understand differe	ent Malabsorption Syndro						-				
Unit-No.		Con	itent	Contact		Lear	rning	Outcom	ie	KL			
	Nut	ritional care for met	abolic disorders	Hour									
		Diabetes mellitus: Types, etiology, symptoms, netabolic changes and dietary management.			Learn the importance of								
I		Gout, phenylketonuria, lactose intolerance,			application of therapeutic diet				1,2				
		nypo and hyper thyroidism-Causes, symptoms			ın d	in different conditions.							
	and	dietary managemen											
			ases of cardiovascular										
	-	ystems-Hypertension, hyperlipidaemia,			Understand and describe								
		rosclerosis, coronar	9	different cardiovascular disease and modify the diet									
II		gestive heart failure:						1,2					
		dietary managemen ary fat and developr		according to the disease condition of the patient									
		ary rat and developt ases.											
		ritional care for dise	ases of kidney and		Understand and describe								
		nrinary tract- Nephritis, nephritic syndrome, nephrolithiasis, renal failure: Etiology,			different renal diseases and								
III										1,2			
	_	ptoms, dietary mana		the disease condition of the									
	dial	ysis.		pati	ent								
	Nuti	ritional care for can	cer and aids: Causative		Develops the skills to use the knowledge of modifying the								
		and risk factors, chronic complications, different stages of both the disorders, dietary modifications, food to be included and foods to			diet according to the disease condition of the patient Understand the term surgery								
IV	be a	voided.	10						1,2				
••	Foo	Food Allergy – Diagnosis and treatment. Surgery, trauma and burns- Physiological changes, nutritional care and management.						to guid accordi		1,4			
						-		dition ar	-				
								irement					
	Use	of food exchange li		pati		44							
					•								
\mathbf{v}			g disorders: Dietary	8				m dietic		1,2			
•	treatment and other recommendation, addictive			•	and	diffe	ent ro	les play	ed.	,_			

	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.		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	Course Outcome (CO)	Mapped Program Outcome				
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				

	SEMESTER IV Course Title NUTRITION THROUGH LIFECYCLE										
Course T	itle			HROUGH	I LIF	ECYC	CLE				
Course co	ode	23BSFD223R	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				Nil				
Program		Bachelor of Science in Food, Nutrition and Dietetics									
Semeste	er	Spring/ IV semester of second year of the programme									
Course	e		e physiological stages		_	•					
Objectiv			e nutritional requirem				_				
		_	sed on the requirement			group	os.				
CO1		Learn the concept of balanced diet and meal planning Discuss the physiology and dietary requirements during pregnancy and lactation.									
CO2											
CO3			nal requirements duri logical changes in the								
C04		* ·	changes during vario							out	
CO5		lifecycle.	changes during vario	ous stages c	n grov	viii aii	u ueven	эршеп	t unougn	out	
Unit-	1	mecycle.		Contact							
No.		Conte	nt	Hour		Lea	rning (Outcon	ne	KL	
110.	Ral	lance diet and meal	nlanning:	Hour							
		finition, importance of									
		ferent age groups, im		To know about the balance diet							
I		be followed while plan	8						1,2		
		t, Food Pyramid, Prin	-		and	its req	uireme	nt.		,	
		olved in meal plannir									
	infl	uence meal planning	, food groups.								
	Nu	trition in pregnancy	and lactation:								
	Pre	gnancy- Physiologica									
	_	gnancy, nutrition req		To l							
II		mplications of pregna	10	nutritional requirement during pregnancy and lactation							
		ctation- Physiology of									
		mones, nutritional re									
		al planning for pregn									
		men tuition during infon	are Infonce								
		trition during infan owth and developmer	•								
		uirements, breast fee									
	_	ant formula. Introduc	-								
		plementary foods, w									
	_	nning for infants.	caming roods. Wear								
	_	tritional needs duri	ng childhood:		To l	earn th	ne nutri	ional			
III		ly childhood (Toddle	•	14	requ	ireme	nt durin	g infa	ncy and	1,2	
		schoolers) - growth s			chile	dhood					
	nee	eds, nutritional related	d problems,								
	fee	ding Pattern and prob									
		nool children- Nutritie									
	_	portance of snacks, so							ļ		
	pla	nning for children									
					To 1	agrn tl	ne physi	cal or	d		
IV	Nu	trition adolescence:	12			changes		~	1,2		
		psychological changes, body image,		·			require			,-	

	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			
v	Planning for adults Nutritional needs during old age: Process of ageing, common health problems during old age, and dietary modifications specially reference to consistency of the food. Meal planning for old age peoples.	10	To learn the nutritional requirement during old age	1,2

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			I (BAK		SCIEN	· ·				
Course c	ode 23BS	SFD225R	Total credits: 1	L	T	P	S	R	O/F	C			
Due negui	iaita	NI:1	Co voquisito	0	0	0	4 N:	0	0	1			
Pre-requi		Nil	Co-requisite	in Food	Nutri	tion or	N:						
Semest		Bachelor of Science in Food, Nutrition and Dietetics Spring/ IV semester of second year of the programme											
Semest		Spring/ IV semester of second year of the programme 1. To provide knowledge on science behind baking.											
Cours	$e \mid_{2 \text{ To r}}$	2. To provide knowledge on basic functions of all the ingredients used in different products											
Objectiv	700	3. To master in fundamental mixing methods and their applications											
CO1			cient use of measuring										
CO2			al mixing methods and										
CO3	Succes	ssfully bake a	a variety of basic bake	ed goods	with c	onsiste	nt qual	lity					
CO4	Identif	y and trouble	eshoot common bakir	ng proble	ms								
CO5		_	of baking principles to	create a	variet	y of bal	ked go	ods wit	h varying	glevels			
	of com	plexity.											
Unit-		Content Contact Learning Outcome			KL								
No.		Hour											
		ng Techniqu											
			g: Practice accurate										
		ighing and measuring of ingredients ng various tools (scales, measuring cups,											
	spoons).												
	•	xing Methods:											
	_		ce creaming method,		De	Develop fundamental baking							
		_	sking method.			ls like a							
_	_		nd doughs using	3	mea	asureme	ents, N	lixing r	nethods,	1 2 2 4			
I	different mi	ferent mixing techniques.			Bal	Baking techniques, identify and			1,2,3,4				
	Baking Tec	king Techniques:			troi	troubleshoot common baking							
		arn to use different types of ovens			pro	problems							
	•	nal, convection	·										
			, muffins, and										
	simple brea		Green demonstrate and										
		•	fy and troubleshoot ns (e.g., overbaking,										
		g, uneven ris	-										
	Bread Mak		C).										
		0	o activate yeast and										
		its role in br											
	Bread Doug	gh Preparatio	on: Prepare basic										
	bread dougl	h using straig	ght dough and										
		dough meth-			Les	rning a	hout te	echniqu	ies of				
II		_	actice shaping bread	3		king bro		cenniqu	01	1,2,3,4			
	-	various form	s (loaves, rolls,			8							
	buns).	Tur al a mak a m al 41s	. :										
	_		e importance of										
	_	_	oofing conditions. ferent types of bread										
	_		eat bread, rolls).										
	Cookies an		on orona, 10115).		То	emnhas	size ho	th the t	echnical				
III			on: Prepare cookie	5		_		cookie		1,2,3,4			
	2 3 3 3 2 3 0 0	Parati					11.						

	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).		production (mixing, shaping, baking) and the understanding of the underlying principles that contribute to successful cookie making.	
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							

			SEMEST	ER I	V								
Course T	itle		FOOD	TECI	HNOL	OG	Y II						
Course co	ode 23BSFD2	24R	Total credit	s: 4		L	T	P	S	R	O/F	7	С
Course Co	23DSF D2.	24IX	Total hours: 45	T+30)P	3	0	2	0	0	0		4
Pre-requi	site Nil		Co-requisi	te					N	il			
Program	me	I	Bachelor of Science	in Fo	ood, Nu	utri	tion a	nd Di	ieteti	cs			
Semeste	er	S	pring/ IV semester	of sec	cond y	ear	of the	prog	ramı	ne			
Course	a	_	rocessing of dairy, e			irra	adiatec	l food					
Objectiv	1.2 To know a	about p	reservation of variou	ıs foo	ods.								
	3. To learn a		fferent packaging te					l indu	stry.				
CO1			od processing and pro										
CO2		dairy t	echnology. Discuss	differ	ent pro	oces	sing to	echnic	ques o	of mill	k and	mil	k
	products												
CO3	•		rusion technology in		•	_							
CO4			ssification of food in										sing
CO5	_	Discuss packaging materials, food additives and food quality evaluation techniques in											
	product deve	elopme	nt										
Unit-No.		Content			Contac	t	Le	arnin	ıg Ou	tcom	e		KL
					Hour	ur							
			s food processing										
	_	nd preservation technologies											
	_	reezing-Introduction to refrigeration and											
	_	eezing, definition, principle of freezing,											
τ .	_	nanges occurring during freezing, types of											
		eezing, thawing, changes during thawing			40		Learni	-			S		
I		d its effect on food.			10		food p		_				1,2
	'	rying and Dehydration-Definition, drying					preser	vatioi	i tech	nolog	ies		
	•	a means of preservation, differences tween sun drying and dehydration (i.e.											
	· ·	_	•										
	factors affect ing	_	at and mass transfer,										
	driers used in the												
	Dairy technolo		<u>*</u>										
	pasteurization, h												
	_	_	ion, recombination,				Learni	ina ah	out d	airv			
	reconstitution, di						techno	-		-			
II	different milk pr		-		8		advan	••					1,2
	Dairying, Nation		-				techni	_	.000	,,,,,			
			l, Development in				teemin	que					
	milk processing		.,										
		- introd	luction, classification	n									
			lemerits of extrusion		_		Learni	_					1.0
III					7		produ		its p	rocess	ing		1,2
		chnology, effect of Extruded foods on attritive value of foods.					techni	ques					
			duction, kinds of										
		izing radiations used in food irradiation,											
	_		sing in food industr						S				
IV	concept of cold s	_		aspect of advanced food							1,2		
	effects of food ir						proces						
	irradiated foods		•				-	J					
	Thermal Proces	ssing-C	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

 $\underline{https://www.youtube.com/watch?v=yVPWcnBiFeQ}$

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	R – IV							
Course	Title		ENGLISH FO	OR EMP	LOYA	BILITY	7	_			
Course	code	23UBPD222R	Total credits: 2 Total hours: 60		T	P	S	R	O/F	C	
Pre-req	micita	Nil	Co-requisite	P 0	0	4	0 Nil	0	0	2	
Progra			Bachelor of Science in Food, Nutrition and Dietetics								
Seme			oring/ IV semester o								
Course Objectives		1.To develop publicues, overcoming 2.To provide practicover letters.	3. To teach email etiquette, including the structure of emails and effective drafting								
CO	2	public speaking str Equip students with	Enable students to prepare scripts, understand nonverbal cues, overcome fear, and 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.								
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, and									
Unit- No.		analyze its effects. Conten	t	Contac	t	Learning Outcome					
I	i. Prep Nonve ii. Une Public	c Speaking Skills caration of Scripts are rebal cues of Public a derstanding and Ove c Speaking ctice strategies of Pu	Speaking rcoming Fear of	7	Students will be able to create effective speaking scripts, interpret nonverbal cues, manage public speaking anxiety, and practice effective speaking techniques.					3, 4	
п	letter i. Prep Resur	ctical session on cov	& screening of	5	Students will prepare, submit, and evaluate resumes and cover letters.					3	
III	i.Diff ii.Dra	Etiquettes Ferent Parts of Email Ferent emails effective	ely	5	struc	lents will cture of n effecti	emails vely.	and d	raft	2, 3	
IV	i. Prep Quest	terview Skills (Mock sessions) Preparing Commonly asked Interview uestions Mock Interview sessions			Students will answer common interview questions confidently and perform well in mock interviews.					3, 5	
V	i. Def ii. Typ	ict Management inition pe of Conflict Manag fects of Conflict Ma		8		the fferent fects.	2, 4				

- 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						

			CEN	HECKED	TX 7							
Course	o Titlo		BASIC AC	IESTER –		a cri	TICE	PAC)				
Course	e Hue			redits: 1	L	J SKI T	P	S	R	O/F	C	
Cours	e code	23UULS201R		urs: 30P	0	0	2	0		0/F	1	
Pre-re	anicita	Nil		quisite	U	U	4	Nil	U	U	1	
Progra			achelor of Sc		od N	utritic	n and		rs			
Semo			ring/ IV sem									
		1. To impart knowled								lications	<u> </u>	
Cou		2. Students will be ab	~		•			•	• •			
Objec	ctives	3. Students will be ab					_					
CO	D1	Students will have bas	sic knowledge	e of cookin	g meth	ods.						
CO2 Students will gain the knowledge of organizing & Cleaning of Ro							g of Ro	oms.				
CO)3	Students will be able	to gain the tra	vel manage	ement	conce	pt.					
CO	24	Students will be able	to acquire the	knowledge	of ba	sic ho	usehold	l's ame	nities f	or day-t	О-	
	<i>)</i> 4	day use.										
CO)5	Basic use of Travel & Tourism Management which will prepare students for lifelong										
		learning										
Unit-		Content		Contact			Learni	ng Out	come		KL	
No.				Hour	~ 1					_		
		luction to Accommoda		Students will be able to effectively								
	1	gement		handle telephone calls, organize rooms efficiently, utilize appropriate								
I		phone handling techniq	8	cleaning agents and equipment,								
1	_	nizing of Rooms.	0	perform professional bed-making, and								
		ning agents. ning equipment's and u		maintain a high standard of								
		making Process.	1505.		cleanliness and guest service							
		mentals of Cooking		Students will demonstrate an								
		nition of cookery –Aim	ı &				ling of			iples.		
		ctives of cooking.		_			ygienic		_	_		
II	_	of basic cooking equip	ment's	7		•	se of co	•			3	
	• Perso	onal Hygiene and Safet	y		and	fuels to	o achie	ve desii	ed cul	inary		
	• Use	of Fire & Fuels			resul	lts.						
	Metho	ods of Cooking			Stud	ents w	ill dem	onstrat	e knov	vledge		
		erent Cuts.			of va	arious	cooking	g metho	ds, in	cluding		
III		of Herbs and Spices.		7	diffe	rent cu	uts of n	neat, the	e use o	f herbs	2, 3	
111		c Food and Beverage P	renaration	,		_	, basic f			rage	2, 3	
		onal food Habits.	reparation.				ı techni	_				
	_				unde	erstand	ling of 1	regiona	l food	habits		
		& Format's										
	• C –fo				Und	erstand	d and u	tilize C	-form	for		
IV		rvation form		8	Understand and utilize C-form for interstate sale of goods to claim input tax credit.						3, 5	
	_	stration form										
	_	port Application form										
	• Lega	l Rent 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				

SEMESTER – IV														
Course	Course Title DIGITAL LITERACY									1				
Course	code	23UUDL101R	Total credits: 1 Total hours: 30H		T 0	P 2	S 0	R 0	0/F 0	C 1				
Pre-rec	misite	Nil	Co-requisite	Nil	U	<u> </u>	U	U	U	1				
	Programme Bachelor of Science in Food, Nutrition and Dietetics													
Seme			Spring/ IV semester											
		1. Students will be							nd their	uses.				
Cou	rse	2. Students will be	•	•	•									
Objec	tives	3. Students will be	able to use the Intern	net efficier	tly for	require	d infor	mation a	as well a	as for				
		digital financial t	ransactions.											
CC	\1	Students will have b	asic understanding	of Comput	er Hard	ware, S	oftwa	re and C	Compute	r				
	/1	handling.												
CC)2	Students will be able	e to solve basic info	rmation ma	anagem	ent issu	ies usi	ng MS-0	Office					
) <u> </u>	Products.												
CC)3	Students will be able	•			-								
CC)4	Students will be able	e to use computing t	echnically	ethical	ly, safe	ly, sec	urely an	d legally	y for				
	•	day-to-day use.												
	_	Understand the fund				_	•			ating				
CC)5	accounts and utilizing	ng digital payment p	latforms si	uch as c	redit ca	ırds, d	ebit card	ls, net					
	1	banking, and UPI.			ı					1				
Unit-		Content		Contact		Learn	ing O	utcome		KL				
No.				Hour	Толи	doratan	d tha f	undame	ntol					
		mentals of Comput	=											
		i. Components of a Computer and their			components of a computer system, their functions, and explore the									
I		anctions. . Different Types of Computers and their applications.			diverse types of computers and					3, 4				
					their applications across various									
	Аррис	ations.		domai		ions ac	7000 741	1000						
		7.50 0.00				dationa	al knowl	edge in						
		luction to MS-Office			_			iite, incl	-					
		ponents of the MS-O			profic	iency in	rcreat	ing and						
II		ating documents with eating Presentations v		5	manip	ulating	docun	nents wi	th	3				
	Power	~	illi Mis-			presen								
		eating Spreadsheets w	ith MS-Excel				and sp	readshee	ets with					
					Excel.									
		luction to Internet &	•											
		duction to Computer	Networks and		To un	derstan	d fund	amental						
	Interne		ites and Web		conce	pts of c	omput	er netwo	orks and					
		rld Wide Web, Webs	nes and wed					ng web						
III	_	s, Web browsing. b Searching, Search	engines	5	brows	ing, sea	rching	g, email	usage,	2, 3				
		action to Google Search	-			•		rity awa	areness,					
		using Keywords, top	-		_	ularly f	ocusin	g on						
		eation and use of Ema			cyber	crimes.								
		er Crimes.												
		luction to Social Me	dia		To un	derstan	d the r	ower an	ıd					
		Power of social medi					_	media in						
IV		media in present scer		7	curren	t scena	rio, lea	arn to cr	eate	3, 5				
		ating accounts and us						social m						
	social	media portals and Ap	ps like WhatsApp,		platforms, and develop a strong									
<u> </u>		practions, and develop a strong												

	Facebook, Twitter, Instagram, LinkedIn.		understanding of appropriate social	
	iii. Social Media Etiquettes.		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							
Course T	itle		EXTRA-CURR	ICULA	AR ACT	IVITI	ES				
Course co	ode	23UBEC221R	Total credits: 0.5	L	T	P	S	R	O/F	C	
Course coue		25 CDE C221K		0	0	0	2	0	0	0.5	
Pre-requi	site	Nil	Co-requisite				Nil				
Program			achelor of Science in								
Semeste	er		oring/ IV semester of								
Course Objectiv		 To ascertain physical and mental development of the students and select best performers for state, national and international level competition. To enhance and improve student's talents in the field of sports, yoga, music, dance, drama, etc through AdtU club activities and workshops. To improve their ability to solve problems creatively and effectively. 									
CO1		Enhance Leadership activities.	Skills-Students will	develop	leaders	hip abi	lities	throug			
CO2		Improve Social Interaction-Students will learn to interact and build relationships with others. Develop Personal Interests and Hobbies- Students will explore and develop their personal									
CO3		interests and hobbie	es.								
CO4		Strengthen Problem creatively and effect	-Solving Skills- Stude tively.	ents wil	l improv	e their	abili	ty to so	olve pro	blems	
CO5		Foster Cultural Awa different cultures.	areness- Students will	gain a l	better un	dersta	nding	and a	ppreciati	ion of	
Unit- No.		Cor	ntent		Contact Hour	Le	arnin	ıg Out	come	KL	
I	par cur Un Bas and Mu acti par cor Rei are	Based on the learner's interest they can participate in various sports, music, and cocurricular activities joining the clubs of the University (Football, Futsal; Cricket; Swimming; Basketball; Badminton; Table Tennis; athletics and other outdoor and indoor games; Dance; Music; Vocals; Photography; Drama; Literary activities); The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies; Renowned skilled professionals/ personalities are invited organizing workshops to promote the talents of the students. Hour 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					

le CLII								
	NICAL NU				ı	1	T	T
de 23RSFD311R(CN)		L	T	P	S	R	O/F	C
Total Hours		3	0	2	0	0	0	4
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		-	_	_				
					sease s	state.		
					aalth d	nd w	allhain	
				фино	115 111 (iiscas	cs state	,
				n				
					eeding	meth	ods.	
Content	Co	ntact						KL
Ethios and assessmilities of Distinion		iour						
-	mulan	5	Role	of diet	ician			1,2
	anning							
	-	10		-	_			1,2
-			different, ode of feeding				1,2	
the nutritional requirements of the refer woman and man, including factors influ energy expenditure, estimation method	rence nencing s, and	10	Concisely covers the key aspects of energy, BEE, and nutritional requirements.				and	1,2
clinical settings. Routine hospital diets: Preoperative and postoperative diets, st and review of hospital diet. Basic conce and methods of - (a) Oral feeding (b) T	udy epts ube	10	nutritional assessment in clinical settings, including the study and review of routine hospital diets (preoperative and postoperative), and to explore the basic concepts and methods of oral, tube, and				ng the ine ive to ots and deeding.	1,2
Nutritional management in specific disconditions.	ease	10	skills t	o applon in t	ly prin he ma	ciples nagen	of nent of	1,2
 nutritive value of: Routine hospital di Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculation 	et: ns of (NG)	30	To develop the ability to plan, prepare, and calculate the nutritive value of various hospital diets (routine, liquid, soft) and enteral feeds (NG)				1,2,3,4	
	te Nil Co-Reques Bachelor of Science Bachelor of Science Fall/ V semester I. To study about different aspect of 2. To study about the different nutries 3. To understand the symptoms of dient Understand the different aspect of 6. Learn and apply different aspect of 6. Learn and apply different aspect of 6. Acquired knowledge on planning of 6. Apply the importance of therapeutic 6. Evaluate the significance in the mod 7. Ethics and responsibilities of Dietician, 7. Dietetic Association. Scopes. Principles of therapeutic diets, menu ple for specific diseases and role of diet counseling in hospital settings. Energy, Basal Energy Expenditure (BE 6. the nutritional requirements of the refer 8. woman and man, including factors influency expenditure, estimation methods 8. the role of macronutrients and micronum 1. Determination of nutritional assessment 1. Colored Feeding (c) Parental nutrition (d) Intraversed feeding (e) Parental nutrition (d) Intraversed feeds and Jejunostomy (JJ) feed (e) Menu planning for febrile conditions	te Nil Co-Requisite es Bachelor of Science in For Fall/ V semester of third 1. To study about different aspect of diet modifications of the symptoms of different defications of the symptoms of the sympt	te Nil Co-Requisite Sachelor of Science in Food, Nu Fall/ V semester of third year of 1. To study about different aspect of diet modification 2. To study about the different nutrient modification 3. To understand the symptoms of different deficiency Understand the different aspect of food nutrients and in Learn and apply different aspect of diet modification in Acquired knowledge on planning of different hospital Apply the importance of therapeutic diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modifications of diet in diseases on Evaluate the significance in the modification of diet on the modification of diet in diseases on Evaluate the significance in the modification of diet on the modification of diet of the modification of nutrition and application of nutrition of diet of the modification of nutritive value of: Routine hospital diet: Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) feeds and Jejunostomy (JJ) feed Men	te Nil Co-Requisite es Bachelor of Science in Food, Nutrition Fall/ V semester of third year of the pale 2. To study about different aspect of diet modification and ad 2. To study about the different aspect of fire modification and idifferent aspect of diet modification and ad 2. To study about the different aspect of diet modification and ad 2. To understand the symptoms of different deficiency diseas Understand the different aspect of food nutrients and its affect Learn and apply different aspect of diet modification and ad Acquired knowledge on planning of different hospital diet Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different aspect of diet modifications of diet in different aspect of diet modification and add Acquired knowledge on planning of different hospital diet Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different aspect of diet modification and add Acquired knowledge on planning of different hospital diet Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different aspect of diet modification and add the seaso condition Contact Hour Indicate I	te Nil Co-Requisite Sachelor of Science in Food, Nutrition & Di Fall/ V semester of third year of the progra 1. To study about different aspect of diet modification and adaptatic 2. To study about the different nutrient modification and different disc. To study about the different nutrient modification and adaptatic 2. To study about the different nutrient modification and different disc. To study about the different nutrient modification and adaptatio 3. To understand the symptoms of different deficiency diseases. Understand the different aspect of food nutrients and its affect in h Learn and apply different aspect of diet modification and adaptatio Acquired knowledge on planning of different hospital diet Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different fee to the different deficiency diseases condition. Ethics and responsibilities of Dictician, Indian Dictetic Association. Scopes. Principles of therapeutic diets, menu planning for specific diseases and role of diet counseling in hospital settings. Energy, Basal Energy Expenditure (BEE), and the nutritional requirements of the reference woman and man, including factors influencing energy expenditure, estimation methods, and the role of macronutrients and micronutrients in maintaining health. Determination of nutritional assessment in clinical settings. Routine hospital diets: Preoperative and postoperative diets, study and review of hospital diet. Basic concepts and methods of - (a) Oral feeding (b) Tube feeding (c) Parental nutrition (d) Intravenous feeding. Nutritional management in specific disease conditions. Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet; Soft) and entity, plan methods of the planning, preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) feeds and Jejunostomy (JJ) feed Planning preparations and calculations of nutritive value o	te Nil Co-Requisite Nil Co-Requisite Sachelor of Science in Food, Nutrition & Dietetics Fall/ V semester of third year of the programme 1. To study about different aspect of diet modification and adaptations. 2. To study about the different nutrient modification at different disease s. 3. To understand the symptoms of different deficiency diseases. Understand the different aspect of food nutrients and its affect in health a Learn and apply different aspect of diet modification and adaptations in deciding and poly different aspect of diet modification and adaptations in deciding and poly different aspect of diet modification and adaptations in deciding and poly the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different feeding Evaluate the significance in the modifications of diet in different feeding Contact Hour Ethics and responsibilities of Dietician, Indian Dietetic Association. Scopes. Principles of therapeutic diets, menu planning for specific diseases and role of diet counseling in hospital settings. Energy, Basal Energy Expenditure (BEE), and the nutritional requirements of the reference woman and man, including factors influencing energy expenditure, estimation methods, and the role of macronutrients and micronutrients in maintaining health. Determination of nutritional assessment in clinical settings. Routine hospital diets: Preoperative and postoperative diets, study and review of hospital diet. Basic concepts and methods of - (a) Oral feeding (b) Tube feeding (c) Parental nutrition (d) Intravenous feeding. Nutritional management in specific disease conditions. Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) feeds and Jejunostomy (JI) feed Planning preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) feeds and	te Nil Co-Requisite Bachelor of Science in Food, Nutrition & Dietetics Fall V semester of third year of the programme 1. To study about different aspect of diet modification and adaptations. 2. To study about the different nutrient modification and adaptations. 3. To understand the symptoms of different deficiency diseases. Understand the different aspect of diet modification and adaptations in disease Acquired knowledge on planning of different hospital diet Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of date in different feeding meth Content Content Contact Hour Ethics and responsibilities of Dietician, Indian Dietetic Association. Scopes. Principles of therapeutic diets, menu planning for specific diseases and role of diet counseling in hospital settings. Energy, Basal Energy Expenditure (BEE), and the nutritional requirements of the reference woman and man, including factors influencing energy expenditure, estimation methods, and the role of macronutrients and micronutrients in maintaining health. Determination of nutritional assessment in clinical settings. Routine hospital diets: Preoperative and postoperative diets, study and review of hospital diets. Basic concepts and methods of - (a) Oral feeding (b) Tube feeding (c) Parental nutrition (d) Intravenous feeding. Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) feeds and Jejunostomy (JJ) feed Menu planning for febrile conditions	te Nil Co-Requisite Sachelor of Science in Food, Nutrition & Dietetics Fall V semester of third year of the programme 1. To study about different aspect of diet modification and adaptations. 2. To study about the different nutrient modification and its affect in health and wellbeing. 3. To understand the symptoms of different deficiency diseases. Understand the different aspect of food nutrients and its affect in health and wellbeing. Learn and apply different aspect of food nutrients and its affect in health and wellbeing. Acquired knowledge on planning of different hospital diet. Apply the importance of therapeutic diet in diseases condition Evaluate the significance in the modifications of diet in different feeding methods. Contact Hour Ethics and responsibilities of Dietician, Indian injectetic Association. Scopes. Principles of therapeutic diets, menu planning for specific diseases and role of diet counseling in hospital settings. Energy, Basal Energy Expenditure (BEE), and the nutritional requirements of the reference woman and man, including factors influencing energy expenditure, estimation methods, and the role of macronutrients and micronutrients in maintaining health. Determination of nutritional assessment in clinical settings. Routine hospital diets: Preoperative and postoperative diets, study and review of hospital diet. Basic concepts and methods of - (a) Oral feeding (b) Tube feeding (c) Parental nutrition (d) Intravenous feeding. Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet. Soft diet Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculations of nutritive value of: Routine hospital diet: Liquid diet: Clear liquid, Full fluid, Semisolid diet, Soft diet Planning, preparations and calculations of nutritive value of: Feeds: Nasogastric (NG) JJ), plan menus for fe

peers or standardized patients, focusing on	analysis, emphasizing	
communication, motivational interviewing,	communication, motivational	
and behavior change techniques.	interviewing, and behavior	
Analyze case studies of patients with	change techniques.	
specific diseases (e.g., diabetes, cancer,		
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:

 $\frac{https://www.cdss.ca.gov/agedblinddisabled/res/VPTC2/9\%20Food\%20Nutrition\%20and\%20Preparation/}{Types_of_Therapeutic_Diets.pdf}$

	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	le	CLINICAL NU'	TRIT	ION I	П							
Course Co	de 23BSFD312R(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						
Programm		achelor of Science in Food										
Semester		Fall/ V semester of third y										
~		e different biochemical me					•					
Course		2.To understand how this metabolism takes place in correlation with the nutrients of the										
Objective		0.1100 1.01		1.								
		symptoms of different defic				• • •						
CO1		ate between obesity, overw	•		ınderw	eight	,					
		fications and associated her			: cc:							
CO2		al role of nutrition in maint ses (CVDs) such as atherose	_				-	-	_			
		rehensive understanding of										
	_	symptoms, metabolic distu					_		nce,			
CO3	1 1	• •			_			•	nd			
		management, pharmacotherapy (including insulin types and hypoglycemic agents), and										
		potential long-term complications. Demonstrate a comprehensive understanding of the role of nutrition in the management of										
CO4	renal diseases											
	Understand the vario	Understand the various causes of liver diseases, including viral infections (hepatitis),										
CO5		alcohol abuse, non-alcoholic fatty liver disease (NAFLD), autoimmune disorders, and										
	genetic condition.	genetic condition.										
Unit-No.	Con	tent	Contact			Learning Outcome			KL			
			Hour		Licui							
_	Obesity and underweig		_	١,	D 1 /				1.0			
I	complication and health	· · · · · · · · · · · · · · · · · · ·	5	ا ا	Role of dietician				1,2			
	treatment and other rec											
	Role of nutrition in cardincidence of Atheroscle	-										
	principles, Hyperlipide	,										
II	causes and dietary treat	• • •	10	Learning of hospital diet different, ode of feeding					1,2			
	restricted diet, level of		10						1,2			
	sources of sodium, dan											
	restriction.	5										
	Diet in Diabetes mellitu	is: a) Incidence and										
	predisposing factors. b)	·		(Concise	ely co	vers th	ne key				
TTT	tests for detection. c) M	letabolism in diabetes	10	a	spects	of en	ergy, l	BEE,	1.2			
III	d) Dietary treatment &	meal management e)	10	a	nd nut	rition	al		1,2			
	Hypoglycemic agent, in	nsulin and its types. f)		re	equirer	nents						
	Complication of diabeter	es										
					o unde			_				
	Diet in Renal diseases:				rinciple							
	symptoms and dietary t				ssessm							
IV	chronic glomeruloneph	-	10		ettings,		_		1,2			
	failure, dialysis. urinary				tudy an							
	treatment, acid and alka				outine l	_		ıs				
	neutral foods and dietar	y meannent.			ostope			to				
				P	postoperative), and to							

	Diet in diseases of the liver, gall bladder and		explore the basic concepts and methods of oral, tube, and parenteral/intravenous feeding.	
V	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	 Planning and preparation of DASH Diet 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 nutritive value. Planning, preparation and calculation of nutritive value of renal disorders: Renal calculi and Renal Transplantation 	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	Course Outcome (CO)	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					

	D0.43			TER – V		TON 1						
Course 7	itle	<u> </u>	APPI Total Credit	LIED NU				C	D	O/E		
Course C	Code	23BSFD311R(AN)	Total Hours: 45		1 3	T 0	P 2	S 0	R 0	O/F 0	C 4	
Pre-requ	isite	Nil	Co-Requis		3	U	4		lil	U	-	
Program		1411	B.Sc. Foo		ion &	Diet	etics		111			
Semest			Fall/ V semester	-				ramm	e			
		1.To study about di										
Cours		2. To study about th	*			•		_	ict dev	elopment		
Objecti	ves	3. To acquire knowl		-				_		_		
CO1		Reflect on the role	Reflect on the role of food trends in the new product development process									
CO2		Design a food prod	uct through the app	olication o	f knov	wledg	ge of f	ood ii	ngredi	ents and		
COZ		Functional foods.										
CO3		Create and evaluate				_				ply packa	aging	
CO4		Acquired knowledg			-							
CO5		Combine theoretica	l knowledge and p	ractical sk	cills to	repro	oduce	existi	ing foo	od produc	ts by	
		ensuring.		Contact	1							
Unit-No.	Unit-No. Content					L	earni	ng Ot	itcom	e	KL	
	NT	- f J J4 D - f		Hour								
		food product- Defi sification, factors sha			Dofl	act or	thor	ola of	food	trands in		
I		elopment: social con-	8				le of food trends in					
1		ern, impact of mark	0	the new product development Process						1,2		
		technology.	et place illitaence									
		duct development-		Design a food product through the								
		dardization methods			•							
II	porti	on control; Calculat	8	application of knowledge of food						1,2		
	valu	e and cost of produc		ingredients and Functional foods								
	and	storage stability eval		Tunctional 100ds								
		duct evaluation- De	•		Crea	te and	d eval	nate a	prodi	act using		
		ecard and analysis of	f data. Selection	the development process. Design						•		
III		training of judges.		10	and a	1,2						
		kaging-Suitability, d	levelopment of		For food products							
	•	tages and Labeling. Lity control – Object										
	_	tions of quality cont										
		ity control in food in										
	•	d quality assurance	•		Eval	uate i	orođu	ct qua	lity an	d		
IV		pany quality assuran	•	9		_	opert	_	110) (11)		1,2	
		obiological concern				JI	1					
		aging quality in sup										
	marl	keting of food produ	cts.									
	Gov	ernment regulation	s in quality									
	cont											
		O/WHO codex Alin								edge and		
V		mission, PFA, AGM		10	practical skills to reproduce existing food products by ensuring proper food standards						1,2	
		average quality (FAC										
		oodgrains, ISO9000										
		CCP-Background, p	rinciples, benefits									
	and	limitation.			<u> </u>							

	Consumer Protection Act (CPA) Food adulteration – Common adulterants and tests to detect common adulterants.		Learning about trends and	
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	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	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	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 Ti	itle		APPLIED NUTR	ITION	Ι							
Course Co	ode	23BSFD312R(AN)	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	0.701	•			Ni	<u> </u>			
Programn			B.Sc. Food, Nutrition									
Semeste	er		semester of third yea			grai	mme	e				
Course	•	 To study a different aspe To study the different reg 		-		nrod	luoti	010				
Objectiv	es	3. To understand the recent	•	-		_	iucti	011.				
CO1		Understand the different applications of food science in food production and packaging.										
CO2		Learn about the regulatory b							- Pu		.8.	
CO3		Understand the recent trends				~ <i>5</i> J.						
CO4		Acquire knowledge on diffe	rent packaging materia	al.								
CO5		Evaluate the significance of										
			Conta	ct	T		^			T/T		
Unit-No.		Content		Hou	r	Lea	arnı	ng O	utco	me	KL	
		roduction: Concept of food	• • •									
I		asures-basic concept of HAC	CP, Safe food	5		Learn different			1,2			
1		dling practices and			Con	stitu	uents of foods		ods	,		
	stor	<u> </u>	1 ' C 1			Learn technologies						
II		roduction to technologies us cessing: Hot and cold treatm	10		Learn technologies used in food			1,2				
11	_	and Primary Processing.	10							1,2		
		od additives-various types ar			processing Learn different types			nes				
III		lth. Food security-Concept, f	10				of quality evaluation					
		urity. Prevention of Food Ad	-		of food					1,2		
	Reg	gulating authority- Fruit										
IV	Pro	ducts Order (FPO), Meat Pro	oducts Order (MPO),	10		Learn different					1,2	
1 4	Bur	eau of Indian Standards (BIS	10	Regulating authority				rity	1,2			
	ISI,	Agmark.										
		oduction to Food Packaging:	•									
V		kaging Design. Different typ	~ ~	10				ffere		_	1,2	
·		terials. Active and Intelligent	~ ~			of fo	ood j	packa	ging	5	,	
		kaging Regulations and Safe	•									
		troduction to different equip	ment in processing					g the				
		nd preservation	. G. '1' .'			_	_	ent of				
		reservation by heat treatment				_		ng ai	ıd			
371		reservation by heat treatment	-			•	preservation techniques of heat					
VI Practical		reservation by cold treatment	30			_	ies oi it, co		.t	1,2,3,4		
TTacucai		reservation by cold treatment eezing	i. Freezer,deep							anes		
		rifferent methods of drying: N	Mechanical drving		treatment; Technique of dry treatment and				-	S		
		rifferent methods of drying: S	• •		Techniques of							
		reparation of extruded produ			extruded products				s			
	1	erandon of enduded produ										

T1: Rahman, M. S., Handbook of Food Preservation. MARCELDEKKER Inc. 1999

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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								

Diet Counselling —Definition, counselling process-interviewing, counseling and consulting, role of the dietitian, code of ethics, limits. Techniques for obtaining relevant information: nutritional status assessment-anthropometry, clinical information, medical history and general profile, dietary assessment-diet history, 24 hr diet recall, MNA, FFQ, lifestyles, physical activity, stress Theories of counselling, approaches and techniques Developing resources and nutritional aids for education and counseling Developing nutritional assessment form (for ambulatory and non-ambulatory patients) Hour Hour Learn about the Role of a dietitian, ethical codes and responsibilities, assessment of nutritional status and techniques of counseling Learn to develop counseling techniques, planning of modified diet.				SEMESTE	R V									
Course code 23BSFD314R Total credits: 1 Pre-requisite Nil Co-requisite Fall V semester of third year of the programme 1. To review about various techniques used in counselling. 2. To understand the use of various types and techniques of counselling in order to me patients to achieve well-being 3. To understand the significance of dictitian in modifications of therapeutic dict CO1 Understand the principles and procedures of dict counselling and the role of the counselling. CO3 Analyze how acute and chronic illness affects the emotional, psychological well being behavior of the individuals. CO4 Learn the techniques and skill of dictitian CO5 Evaluate the significance of dictitian in modifications of therapeutic dict Content No. Diet Counselling — Definition, counselling process-interviewing, counseling and consulting, role of the dictitian, code of ethics, limits. Techniques for obtaining relevant information: nutritional status assessment-anthropometry, clinical information, medical history and general profile, dietary assessment-diet history, 24 hr diet recall, MNA, FFQ, lifestyles, physical activity, stress Theories of counselling, approaches and techniques Developing resources and nutritional aids for education and counseling Developing nutritional assessment form (for ambulatory and non-ambulatory patients) Representation of the programme No. No. Solve them a clear picture of influence of lifestyle on health and wellbeing. Analyze how acute and chronic illness affects the emotional, psychological well being behavior of the individuals. CO4 Learn the techniques of the dictitian in modifications of therapeutic diet Learn about the Role of a dictitian, ethical codes and responsibilities, assessment of nutritional status and techniques of nutritional status and techniques of counseling techniques, nutritional assessment form (for ambulatory and non-ambulatory patients) Representation to counseling techniques of modified diet and nutritional assessment form (for ambulatory and non-amb	C 7	Γ!41 -		TECHNO PROF	ESSIO	NAL	COUR	SE II	Ι					
Course code 23BSFD314R Total credits: 1	Course	ıtıe		(DIET COUNSELI	NG AN	D PA	TIEN	Γ CAI	RE)					
Pre-requisite Nil Co-requisite Programme Bachelor of Science in Food, Nutrition & Dietetics Semester Fall/ V semester of third year of the programme 1. To review about various techniques used in counselling. 2. To understand the use of various types and techniques of counselling in order to mean patients to achieve well-being and the principles and procedures of diet counselling and the role of the count counselling. CO1 Understand the principles and procedures of diet counselling and the role of the count counter of the individuals. CO2 Give them a clear picture of influence of lifestyle on health and wellbeing. CO3 Analyze how acute and chronic illness affects the emotional, psychological well beint behavior of the individuals. CO4 Learn the techniques and skill of dietitian CO5 Evaluate the significance of dietitian in modifications of therapeutic diet Unit-No. Content Contact Hour Diet Counselling —Definition, counselling process-interviewing, counseling and consulting, role of the dietitian, code of ethics, limits. Techniques for obtaining relevant information: nutritional status assessment-anthropometry, clinical information, medical history and general profile, dietary assessment-diet history, 24 hr diet recall, MNA, FFQ, lifestyles, physical activity, stress Theories of counselling, approaches and techniques of counseling techniques of counseling techniques, nutritional assessment form (for ambulatory and non-ambulatory patients) Beveloping resources and nutritional aids for education and counseling Developing nutritional assessment form (for ambulatory and non-ambulatory patients) Beveloping resources and nutritional aids for education and counseling Developing nutritional assessment form (for ambulatory and non-ambulatory patients)	Course o	ode	23BSFD314R	Total credits: 1								C		
Programme Bachelor of Science in Food, Nutrition & Dietetics					0	0	0	_		0		1		
Semester Fall/ V semester of third year of the programme				•	· Food	NI4-	4							
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X planning of modified dief	ŢŢ			· · · · · · · · · · · · · · · · · · ·	_			-	_		- د	a :		
Working with Hospitalized patients and	11			· ·	8	planning of modified diet charts according to different conditions					1,2	,3,4		
Outpatients charts according to			-	•										
Follow up Monitoring and Evaluation of different conditions		_		nd Evaluation of										
outcome			•											

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	NAL C	COU	RSE]	III						
Course	Title	(COMN	MUNITY EXPERI	IENCE	LEA	RNI	NG)						
Course	code	23BSFDR314R	Total credits: 1	L 0	T	P	S	R	O/F	C			
Pre-requ	nisite	Nil	Co-requisite	U	0	0	4 N	0 il	0	1			
Prograi			of Science in Food	l. Nutri	tion	& Di							
Semes		Fall/ V semester of third year of the programme											
		1. To familiarize the student with concepts of community.											
Course Objectives		2. To work with community and also organizations working in the field of health and											
		nutrition											
		3. To prepare audio visual material for health and nutritional awareness.											
CO	1	Study the community as a con	ncept and the dynar	mic forn	natio	n of i	ts stru	cture	S				
CO2	,	Gain insight regarding the health issues faced in the community and communities											
		understanding of their own issues.											
CO3		Prepare material for health and nutritional awareness.											
CO ₄		Explain various national and		n organi	zatio	ns							
COS	5	Understand the programs in n			1					ı			
Unit-		Content	,	Contac	t	Lea	rning	Outo	ome	KL			
No.	Come	and of muhlic mutuition.		Hour	-								
		ept of public nutrition: ionship between health and nu		Ţ	earni	na th	e conc	ent of	1,2,3				
Ι		blic nutritionists in the fields of	3		Learning the concept public nutrition			cpt of	,4				
	_	public policy related to nutrition		P	paone numition								
	_	municating with Communiti											
		ommunication. Definitions of	The second secon										
	Com	munication. Functions of Com	munication.	_	I	Learning about the communication			ie	1,2,3			
II		s & Levels of Communication		3						,4			
		munication: Collecting information											
	comn	nunity–nutritional and health p	practices.										
	Com	munication Methods: Interpe	ersonal and		T	oorni	ng ab	out					
III	group	b. Steps in community activity	planning:	2		liffere	_	Out		1,2,3			
111	•	aring visual aids-presentations	, posters,	4				ion m	ethod	,4			
	chart	s, information booklets etc.					umca		letilod				
		itional Media in Community				earni	ng ab	Out		1,2,3			
IV		and use of theatre, folksongs,		4			-		ion	,4			
	creati	creating awareness in the community.				community nutrition							
		ies & Programs in Nutrition			ī	earni	ng ab	Out					
\mathbf{V}		national organizations, Nationa		3			-		ition	1,2,3			
•	_	nizations, Primary Health Care	e in India,	•	_	programs in Nutrition & Health				,4			
	Healt	h Programs in India											

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	EARC	CH)					
Course	anda	23BSFD317R	Total credits: 2	L	T	P	S	R	O/F	С			
Course	coue	23DSF D317K	Total Cleuits. 2	0	0	0	0	12	0	2			
Pre-requ	isite	Nil	Co-requisite				1	Nil					
Program	nme	Bachelor of Science in Food, Nutrition and Dietetics											
Semes	ter	Fall/ V semester of third year of the programme											
Cour	Se	1. To enable students to apply experimental methods to solve a given scientific task.											
Object		2. To be able to analyze research data											
-		3. To be able to compile and document research data.											
CO1		Learn to tabulate resea											
CO2	;	Analyze research outcome											
CO3		Corelate with exiting 1											
CO4		Prepare an effective di											
CO5	í	Able to communicate	research outcome										
Unit-No.		Conte	ent		Contac Hour		Learn	ing O	utcome	KL			
I		duction, Comprehensiones, Selection of Topic.	on research search		30	e search election o	of 1,2,3						
п	writing structure Plagi Mapp	s for reference citation, in graph citation and reference ture of Review and specarism, ethnical issue in ping and selection of Jouvledge of discipline and cations.		30				te reviev or a topio	$\pm 1.2.3$				

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	– VI									
Cours	e Title		RESEARCH PROJEC	ГРА	RT II	(DIS	SERTA	TION)					
Cours	e code	23BSFD324R	Total credits: 5	L	T	P	S	R	O/F		C		
Cours	e code	23DSF D324K	Total Credits. 5		0	0	0	30	0		5		
Pre-re	quisite	Nil	Co-requisite		Nil								
Progr	amme	Bachelor of Science in Food, Nutrition and Dietetics											
Sem	ester		Spring/ VI semester of		-			amme					
Course Objectives		1. Apply experimental methods to solve a given scientific task,											
		2. Collect data for evaluation and for statistical treatment, if relevant,											
		3. Use relevant scientific literature.											
CO	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.											
CO		-						oposal.					
CO			te research questions, ob										
CO	04		ed review of relevant liter										
CO)5	Learn to interpret data, draw meaningful conclusions, and relate results to the research											
		question.											
Unit- No.		Со	ntent	•	Conta Hou		Learn	ing Ou	itcome		KL		
I		action, Comprehers, Selection of Top	nsion on research search		10		o learn f researd		nethods		1,2		
п	writing structu Plagian Mappi	for reference citating citation and reference of Review and rism, ethnical issuence and selection of edge of discipline		20	C	o harne ollection	n and	on data	l	1,2			

REFERENCE BOOKS:

publications

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: A Step-by-Step Guide for Beginners" by Ranjit Kumar.

OTHER LEARNING RESOURCES:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037944/

	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	12245679			
1	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	1,2,3,4,5.6,7,8			
-	research topic.	1,2,3,4,3.0,7,0			
5	Learn to interpret data, draw meaningful conclusions, and relate results to the	1,2,3,4,5.6,7,8			
	research question.	1,2,5,7,5,0,7,0			

SEMESTER – VI											
Course T	Course Title HERBAL MEDICINE										
Course c	ode 23FSBO601R	Total credits: 3	L	T	P	S	R	O/F	C		
		Total hours: 45T	3	0	0	0	0	0	3		
Pre-requi		Co-requisite				Nil					
Program		Bachelor of Science in 1									
Semest		Spring/ VI semester of				_	ne				
Cours	Δ	1. To understand the pharmacological properties of medicinal plants.2. To learn the methods of formulation of herbal medicine.									
Objectiv	VAC	2. To learn the methods of formulation of herbal medicine. 3. To evaluate scientific literature on herbal medicine.									
CO1											
CO2		Discuss pharmacological properties of medicinal plants. Explain the methods of formulation of herbal medicine.									
CO3				dicine	•						
CO4		Evaluate scientific literature on herbal medicine. Discuss clinical applications of herbal medicine.									
CO5		legal and ethical issues on		medic	ine.						
Unit-			,	tact					Τ		
No.	C	ontent		our	Learning Outcome				KL		
	Pharmacological Pi	roperties of Medicinal			Describ	e the					
	Plants: Introduction	to pharmacognosy,			pharmacological properties			perties			
I	bioactive compounds	ioactive compounds in plants, mechanisms of			and mechanisms of action			1,2			
	action, examples of	ction, examples of commonly used medicinal			of bioactive compounds in						
	plants.					medicinal plants.					
		Methods of Formulation of Herbal Medicine: Extraction methods, preparation of			Demonstrate knowledge of different extraction and						
									2,3		
II		racts, formulation techniques (tinctures, coctions, infusions, tablets, capsules), ndardization of herbal products.				formulation techniques used in herbal medicine.					
	Evaluation of Scien										
	Herbal Medicine:	unc Literature on			Critically evaluate and			nd			
III		esearch methodologies, critical appraisal of nical studies, systematic reviews, meta-				interpret scientific literature related to herbal medicine.					
		analyses, interpretation of results.									
		ns of Herbal Medicine:			Discuss the clinical applications, safety, and						
		ne in treating common						and			
IV	ailments, evidence-b	ased applications, safety	9	•	efficacy	y of her	bal		3,4		
		ion with conventional			medicines in treating			;			
	medicines.				various	condit	ions.				
	Legal and Ethical I	ssues in Herbal			Understand and discuss			uss the			
	Medicine:				legal and ethical issues						
V	Regulatory framewo		(•	related to the practice and				1,2		
	intellectual property	-	research o		_			, -			
	considerations in res			medicine.							
	consent.										

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									
Course Title INTERNSHIP									
Course Code	23BSFD321R	Total Credits: 6		T	P	S	R	O/F	C
Course Coue	23DSF D321K	Total Credits: 0	0	0	0	24	0	0	6
Pre-requisite	Nil Co-requisite Nil								
Programme	Bacl	nelor of Science in Food,	Nutr	ition a	and Di	ieteti	ics		
Semester	Spri	ng/ VI semester of third	year	of the	progr	ramı	ne		
	1. To demonstrate co	omprehensive knowledge	of the	princi	ples o	f me	dical n	utrition	
Course	therapy (MNT) ac	ross various disease state	S						
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 nutrients in disease prevention and management, and the application of evidence-based dietary guidelines.								
								nes.	
	To accurately assess a patient's nutritional status using various methods, including								
CO2	nutritional history, physical examination, biochemical tests, and anthropometric								
	measurements.								
	Setting realistic dietary goals, recommending appropriate dietary interventions (e.g.,								
CO3	meal planning, supplementation, enteral/parenteral nutrition), and providing clear and								
	concise nutrition education to patients and their families.								
CO4	Effectively communicate with patients, families, and members of the healthcare team						am		
	regarding nutrition-related issues.								
CO5	_	aspects of food service of		ns, inc	cluding	g pur	chasin	ıg, inver	ntory
	control, production p	lanning, 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 cond	tions 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

Bachelor of Science in Forensic Science

OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM Version: 1.1

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 15th & 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023

Chairperson, Board of Studies

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: 156

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.:

- 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
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.

Breakdown of Credits

Sl	Category		Total number
No.	Category		of Credits
		Skill Enhancement Course (SEC)	2
	II	Ability Enhancement Course (AEC)	2
1	University Core	Field Training	0
	(UC)	Discipline Specific Elective (DSE)	3
		Value Added Course (VAC)	1
2	University Elective	Multidisciplinary Course (MDC)	10
	(UE)	7	
		Discipline Specific Core (DSC)	68
3	Program Core (PC)	Field Training	3
3	Program Core (PC)	Research /Industry Internship	9
		Summer Internship	3
4	Program Elective	Discipline Specific Elective (DSE)	36
4	(PE)	Value Added Course (VAC)	0
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	4
	racuity Core (FC)	Ability Enhancement Course (AEC)	8
		Total	156

Breakdown by categories of courses

Sl	Category	Credits	%
No.			
1	Science	152	97.44%
2	Engineering	2	1.28%
3	Commerce and Management	2	1.28%
	Total	156	100%

SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code	Course Title	Course]	En	ga	gen	nei	nt		Maxim	um Ma	rks for	
	No.	Course Coue	Course Title	Category	L	Т	P	S	R	0	C	IA*	SEE*	PE*	Total
			Fundamentals of												
	1.	23BSFS111R	Forensic science &	DSC Major	3	0	2	0	0	0	4	40	60	100	200
			Criminology												
	2	23BSFS112R	Crime Scene	DSC Major	3	0	2	0	0	0	4	40	60	100	200
		23001011210	Management	DBC Major		Ů	_	Ů	Ü			10	00	100	200
Ι	3	23BSFS113R	Criminal Law	DSC Major	2	0	2	0	0	0	3	40	60	100	200
ter	4	23UBPD112R	Elementary English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester I	5	23BSFS114R	Field Based learning and community services	Field Training	0	0	0	0	0	8	1	0	0	100	100
	6	23BSFS115R	Extra-curricular	VAC	0	0	0	4	0	0	1	0	0	100	100
	7	23BSFS116R	MOOCs- I	MDC	0	0	0	0	0	0	1	0	0	100	100
		DSE Minor (Sub-disciplinary) (Any two to be selected)													
	8	23FSCH114R	Chemistry- I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	9	23FSPH115R	Physics-I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
	10	23FSBO116R	Biology- I	DSC Minor	2	0	0	0	0	0	2	40	60	0	100
		То		12	0	10	4	0	8	20	200	300	700	1200	
	S.	Carrera Carla	C TELA	Course]	En	ga	gen	nei	nt		Maximum Marks for			
	No.	Course Code	Course Title	Category	L	T	P	S	R	o	\mathbf{C}	IA*	SEE*	PE*	Total
	1.				2	0	2	0	0	0	4	40	60		200
		23BSFS121R	Forensic Physics	DSC Major	3								00	100	-00
	2	23BSFS121R 23BSFS122R	Forensic Psychology	DSC Major DSC Major	2	0	2	0	0	0	3	40	60	100	200
			·			0	2	0	0	0	3	40			
r II	2	23BSFS122R	Forensic Psychology Fingerprints & other	DSC Major	2 3 0	0	2	0	0				60	100	200
ster II	3	23BSFS122R 23BSFS123R	Forensic Psychology Fingerprints & other impressions	DSC Major DSC Major	2	0	2	0	0	0	4	40	60 60	100 100	200
Semester II	3 4	23BSFS122R 23BSFS123R 23UBPD122R	Forensic Psychology Fingerprints & other impressions Implicit English	DSC Major DSC Major AEC	2 3 0	0 0 0	2	0	0	0	4	40	60 60	100 100 100	200 200 100
Semester II	2 3 4 5	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/	DSC Major DSC Major AEC MDC Field	2 3 0 2	0 0 0	2 4 0	0 0 0	0 0 0	0 0 0	4 2 2	40 0 40	60 60 0 60	100 100 100 0	200 200 100 100
Semester II	2 3 4 5 6	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R 23BSFS124R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/ Community services	DSC Major DSC Major AEC MDC Field Training	2 3 0 2 0	0 0 0 0	2 4 0	0 0 0	0 0 0	0 0 0 8	4 2 2 1	40 0 40 0	60 60 0 60	100 100 100 0 100	200 200 100 100
Semester II	2 3 4 5 6	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R 23BSFS124R 23BSFS125R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/ Community services MOOCs- II	DSC Major DSC Major AEC MDC Field Training DSE VAC sciplinary) (A	2 3 0 2 0 0	0 0 0 0	2 4 0 0 0	0 0 0 0 0 4	0 0 0 0	0 0 0 8 0	4 2 2 1 1	40 0 40 0 0	60 60 0 60 0	100 100 100 0 100 100	200 200 100 100 100
Semester II	2 3 4 5 6	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R 23BSFS124R 23BSFS125R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/ Community services MOOCs- II Extra-Curricular DSE Minor (Sub-di-	DSC Major DSC Major AEC MDC Field Training DSE VAC sciplinary) (A: DSC Minor	2 3 0 2 0 0	0 0 0 0 0 tw	2 4 0 0 0 0 0 t 2	0 0 0 0 4 0 b	0 0 0 0 0	0 0 0 8 0 0	4 2 2 1 1	40 0 40 0 0	60 60 0 60 0	100 100 100 0 100 100	200 200 100 100 100
Semester II	2 3 4 5 6 7 8	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R 23BSFS124R 23BSFS125R 23BSFS126R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/ Community services MOOCs- II Extra-Curricular DSE Minor (Sub-di- Chemistry- II Physics- II	DSC Major DSC Major AEC MDC Field Training DSE VAC sciplinary) (A DSC Minor DSC Minor	2 3 0 2 0 0 0 ny	0 0 0 0 0 tw 0	2 4 0 0 0 0 0 2 2	0 0 0 0 4 o b	0 0 0 0 0	0 0 0 8 0 0	4 2 2 1 1 1 1 1 cted	40 0 40 0 0 0	60 60 0 60 0 0	100 100 100 0 100 100 100	200 200 100 100 100 100 100
Semester II	2 3 4 5 6 7 8	23BSFS122R 23BSFS123R 23UBPD122R 23BSFS127R 23BSFS124R 23BSFS125R 23BSFS126R 23FSCH124R	Forensic Psychology Fingerprints & other impressions Implicit English Environmental Science Field- based learning/ Community services MOOCs- II Extra-Curricular DSE Minor (Sub-di-	DSC Major DSC Major AEC MDC Field Training DSE VAC sciplinary) (A: DSC Minor	2 3 0 2 0 0 0 ny 2	0 0 0 0 0 tw 0 0	2 4 0 0 0 0 2 2 2	0 0 0 0 4 0 b	0 0 0 0 0	0 0 0 8 0 0	4 2 2 1 1 1 1 cted 3	40 0 40 0 0 0 0 0	60 60 0 60 0 0	100 100 100 0 100 100 100	200 200 100 100 100 100 100

	S.		G WI	Course]	En	gaş	gen	nei	nt		Maxim	um Ma	rks for	
	No.	Course Code	Course Title	Category	L		P	_	R		С	IA*	SEE*	PE*	Total
	1.	23BSFS211R	Cyber & Digital Forensic	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	23BSFS212R	Basic Instrumental Analysis	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	3	23BSFS213R	Questioned Document Examination	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	4	23BSFS214R	Forensic Ballistics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	5	23BSFS215R	Techno Professional Course- I	SEC	0	0	2	0	0	0	1	0	0	100	100
Ш	6	23UBPD212R	English Language for excellence	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester	7	23UUFL211R	Personal Financial Literacy	AEC	0	0	2	0	0	0	1	0	0	100	100
Sem	8	23BSFS216R	Field- based learning and community services	Field Training	0	0	0	0	0	8	1	0	0	100	100
	9	23UULS212R	Basic lifesaving skills	SEC	1	0	0	0	0	0	1	40	60	0	100
	10	23UBEC211	Extra-curricular	VAC	0	0	0	4	0	0	1	0	0	100	100
	11	23BSFS218R	MOOCS- III	DSE	0	0	0	0	0	0	1	0	0	100	100
	12	23BSFS219R	MOOCs Open (Generic) Elective- IV	MDC	0	0	0	0	0	0	1	0	0	100	100
			DSE Minor (Sub-	disciplinary) (Ar	ıy	two	o to	o b	e se	lect	ed)			
	13	23FSCH216R	Chemistry- III	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	14	23FSPH217R	Physics- III	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	15	23FSBO218R	Biology- III	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
		To	otal		16	0	20	4	0	8	30	280	420	1300	2000
	SN.	Course Code	Course Title	Course]	En	gaş	gen	nei	nt		Maxim	um Ma	rks for	
	514.			Category	L	T		S	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSFS221R	Forensic Biology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	23BSFS222R	Forensic Chemistry	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	23BSFS223R	Forensic Anthropology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	4	23BSFS224R	Techno professional course- II	SEC	0	0	2	0	0	0	1	0	0	100	100
IV	5	23UBPD222R	English for employability	AEC	0	0	4		0	0	2	0	0	100	100
er]	6	23UCDL222R	Digital Literacy	AEC	0	0	2	0	0	0	1	0	0	100	100
Semester IV	7	23UULS221R	Basic Acclimatizing Skills	SEC	1	0	0	0	0	0	1	40	60	0	100
Se	8	23BSFS225R	MOOCs Open (Generic) Elective- V	MDC	0	0	0	0	0	0	2	0	0	100	100
	9	23BSFS226R	Indian Heritage (Swayam)	VAC	0	0	0	0	0	0	1	0	0	100	100
			DSE Minor (Sub-	disciplinary) (Ar	ıy	two	o to	o b	e se	lect	ed)			
	10	23FSCH225R	Chemistry- IV	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	11	23FSPH226R	Physics- IV	DSC Minor	2	0	2		0	0	3	40	60	100	200
	12	23FSBO227R	Biology- IV	DSC Minor	2	0	2		0	0	3	40	60	100	200
			Total		1 4	1	18	Ω	0	0	26	240	360	1000	1600

	SN.	Course Code	Course Title	Course]	En	ga	geı	ne	nt		Maximum Marks for			
	S11.	Course Code	Course Title	Category	L	T	P	\mathbf{S}	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSFS311R	Forensic Serology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2	23BSFS312R	Forensic Toxicology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	23BSFS313R	Advanced Instrumental Analysis	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	4	23BSFS314R	Techno professional course- III	SEC		0		0		0	1	0	0	100	100
	5	23BSCE311R	MOOCs- VI	DSE	0	0	0	0	0	0	1	0	0	100	100
	6	23BSFS315R	Summer Internship	DSC	0	0	0	0	0	24	3	0	0	100	100
Semester V	7	23BSFS316R	Elementary Statistical analysis & Research Methodology	DSC	2	0	0	0	0	0	2	40	60	0	100
Sei	8	23BSFS317R	Mini Research	DSC	0	0	0	8	0	0	2	0	0	100	100
	9	23BSCE312R	MOOCs Open (Generic) Elective- VII	MDC	0	0	0	0	0	0	2	0	0	100	100
	10	23BSCE313R	The Age of Sustainable Development (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
			DSE Minor (Sub-d	isciplinary) (A	An	y t	wo	to	b	e sel	ecto	ed)			
	11	23FSCH311R	DSC Minor	2	0	2	0	0	0	3	40	60	100	200	
	12	23FSPH312R	Physics- V	DSC Minor	2	0	2	0	0	0	3	40	60	100	200
	13	23FSBO313R	Biology- V	DSC Minor		0	2	0		0	3	40	60	100	200
		Т	otal		_			8	1	24	30	240	360	1100	1700
	SN.	Course Code	Course Title	Course			_	_	ne			Maximum Marks for			
				Category	L				R		C	IA*	SEE*	PE*	Total
	1	23BSFS321R	Multimedia Forensics	DSC Major		0	2	0		0	4	40	60	100	200
	2	23BSFS322R	Forensic Medicine	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3	23BSFS323R	Techno professional course- IV	SEC	0	0	2	0	0	0	1	0	0	100	100
VI	4	23BSCE321R	MOOCs- VIII	DSE	0	0	0	0	0	0	2	0	0	100	100
	5	23BSCE322R	MOOCs Open (Generic) Elective- IX	MDC	0	0	0	0	0	0	2	0	0	100	100
Semester	6	23BSCE323R	AI In Healthcare Specialization (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
	7	23BSFS324R	Dissertation	DSC					0	0	5	0	0	100	100
			DSE Minor (Sub-d			_	_						1		
	9	23FSCH321R	Chemistry- VI	DSC Minor		0	_		<u> </u>	0	3	40	60	100	100
	10	23FSPH322R	Physics- VI	DSC Minor	2	0		_		0	3	40	60	100	100
	11	23FSBO323R	Biology- VI	DSC Minor			2		0	0	3	40	60	100	100
			Total		10	0	10	20	0	0	26	160	240	900	1100

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

			SEMESTE	R – I								
Course Ti	itle		Fundamentals of For	rensic sc	ience	& Criı	ninolo	gy				
Course co	de	23BSFS111R	Total credits: 4	L	T	P	S	R	O/F	ī	C	
			Total hours: 45T+30I	2 3	0	2	0	0	0		4	
Pre-requi	site	Nil	Co-requisite				Nil	•	•			
Programm	ne	Bachelor of Science in Forensic Science										
Semester			Fall/ I semester of f	first yea	r of th	e prog	ramm	e				
Course		1. Understand	the definition, history	y, and so	cope o	f forei	nsic sc	ience.				
Objective	S	2. Learn the b	pasic principles, tools,	and tecl	hnique	s used	l in for	ensic	scien	ce.		
		3. Compreher	nd the elements, chara	cteristic	es, and	cause	es of c	rime, a	and ic	len	tify	
		different ty	pes of criminal behavi	ior.								
		4. Explore cri	iminological theories	and unc	lerstar	d the	goals	and o	bjecti	ve	s of	
		criminolog	-									
			with various crime	investi	gation	agen	cies ii	n Indi	a and	l t	heir	
		functions.										
CO1			y, scope and fundamenta						nics.			
CO2		•	ensic principles, lab hier			-						
CO3			e elements, deviant beha			es, and	societa	al impl	icatior	ns a	along	
			ical aspects in real life c									
CO4		Discuss various crime theories, investigative techniques, criminal profiling, and media's										
		impact on criminal cases along with the practical aspects. Explain India's crime investigating agencies, their roles, and contributions to the criminal										
CO5		-	crime investigating ager	ncies, the	ir roles	s, and c	contribu	itions t	o the c	rin	ninal	
TT 4.	I	justice system.	T		.							
Unit- No.		Co	ntent	Contac Hour		Leari	ning O	utcomo	е	ŀ	KL	
110.	Def	inition of Forens	ic Science, History of	Hour		ndereta	nding l	nietory				
		ensic science, Sc	•				hics, pi	-				
			rensic Science, Basic		30	ope, et	ines, pi	incipic	28			
I		•	ic Science, Tools and	8						1	1,2	
_		•	sic Science, Tasks	· ·						-	-,-	
		•	sic scientists. Code of									
	•	cs for forensic so										
	Prin	ciples of Forens	ic science: Law of		Gı	asp fo	rensic ¡	orincip	les,			
		-	ole of exchange, law			hiera		•				
	of p	rogressive excha	inge, principle of									
II	com	parison, Princip	le of analysis, law of	7						1	1,2	
	prob	oability. Set up o	f Forensic Science									
	Lab	oratory, Hierarcl	ny of experts in									
	Fore	ensic Science La	boratories.									
		•	stics, causes and			_	crime e		is,			
			viant behaviour. Hate		de	viant b	ehavio	r				
		-	rime. Public disorder.									
			workplace violence.									
III		te collar crimes.		10						1	1,2	
			change and crime.									
	-		lers and criminality.									
		_	ention. Theories of									
i	Crin	ninal behaviour.										

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					

			SEMESTER	– I								
Course Ti	itle		Crime Scen	ne Ma	nagei	ment						
Course co	de	23BSFS112R	Total credits: 4	L	T	P	S	R	O/F	C	1	
			Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-requi	site	Nil	Co-requisite		-		Nil					
Programm	ne		Bachelor of Scien	ce in]	Foren	sic Scie	ence					
Semester			Fall/ I semester of fir	st yea	r of t	he prog	ramme)				
Course		1. Comprehend	crime scene definition, in	nporta	nce, r	nanager	nent, ar	d reaso	ons for			
Objective	S	crimes in Ind	ia.									
		2. Recognize va	arious crime scene types a	nd rol	es of j	police, e	experts,	and jud	dicial			
		officers.										
			ding, photography, sketcl	hing, a	nd se	arch tec	hniques	for inc	door ar	ıd		
		outdoor crim										
		· ·	ypes, collection, preserva	tion, a	nd ch	ain of cu	ıstody f	or phys	sical			
		evidence.										
			oles and stages of crime so	cene re	econst	ruction,	from d	ata coll	lection	to		
		theory formu										
CO1			e scene investigation, and	l unde	rstanc	d the rea	asons fo	or crim	e along	g wit	h	
~~~		their practical as	•									
CO2		•	Explain different crime scene types and comprehend the role of investigating agencies in									
002		crime scene management along with their practical aspects.										
CO3		Apply techniques for documenting crime scenes, utilizing various search patterns along										
604		with their practical aspects.										
CO4		Describe the methods for collecting evidences, package, and preserve, and maintain the										
COF		chain of custody for crime exhibits along with their practical aspects.  Analyze crime scene reconstruction using various principles of data collection,										
CO5		-				_	cipies (	or data	i cone	ection	1,	
Unit-	l		ulation, testing, and theor	Cont			ning O	utoom	<u> </u>	KL		
No.		Co	intent	Hou		Leai	mng O	utcom		KL		
110.	Def	ining a crime sce	na Importanca	1100		Grasp c	rima sc	ana				
		-	d processing of Crime			definition						
I	•	ne and Crime sce		8		delilliti	лі, ппр	ortance	, l	1,2		
			ing crime in India.									
			es: Primary, Secondary,			Recogn	ize crin	ne scen	<b>P</b>			
			e of different agencies			types, re		ic scen				
II		olved in crime sce	_	7		c) p cs, 1	0100.			1,2		
		ice, Medico legal	_	_						-,-		
		cers.	1									
	Ba	rricading of crime	e scene; Documenting			Master	crime s	cene				
		-	cene photography and			docume	ntation					
		leography, Crime scene notes. Crime techniques										
	scei	ne sketching: Indo	oor and outdoor,			_						
***	tria	ngulation method, baseline method, polar							1.0			
III	coo	rdinate method.		10	'					1,2		
	Sea	rch: definition, ob	pjectives, search patterns									
	-St	rip method, grid	method, zone/quadrant									
			d (Inward and outward),									
		eel method.										
	wne	eel method.										

IV	Definition, types of physical evidences, Collection, packaging, preservation and forwarding of physical evidences, Chain of custody	10	Understand evidence collection preservation procedures	1,2
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	<ol> <li>Securing the crime scene, clothing, and plan for crime scene management.</li> <li>Demonstration of photography of scene of crime and evidences.</li> <li>Searching and Listing of evidences at indoor crime scene.</li> <li>Searching and Listing of evidences at outdoor crime scene.</li> <li>Sketching of Crime scene by triangulation method.</li> <li>Sketching of Crime scene by baseline method.</li> <li>Sketching of Crime scene by Polar coordinate method.</li> <li>Evidence collection, preservation, packaging, sealing and labeling of physical evidences.</li> <li>Evidence collection, preservation, packaging, sealing and labeling of biological evidences.</li> <li>Demonstration of reconstruction of scene of crime</li> </ol>	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	1, 2, 6					
1	reasons for crime along with their practical aspects.	1, 2, 0					
	Explain different crime scene types and comprehend the role						
2	of investigating agencies in crime scene management along	1, 2, 3					
	with their practical aspects.						
3	Apply techniques for documenting crime scenes, utilizing	1, 2, 3, 7					
3	various search patterns along with their practical aspects	1, 2, 3, 7					
	Describe the methods for collecting evidences, package, and						
4	preserve, and maintain the chain of custody for crime exhibits	1, 2, 6, 7, 8					
	along with their practical aspects.						
	Analyze crime scene reconstruction using various principles						
5	of data collection, hypothesis formulation, testing, and theory	1, 2, 3					
	formation.						

			SEMEST	ER – I								
Course Ti	tle			Criminal L	aw							
Course co	de	23BSFS113R	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-requis					Nil				
Programn	ne		Bachelor of S									
Semester			Fall/ I semester of									
Course		_	1. Grasp offence forms, case classification, legislation components, judicial hierarchy.									
Objective	S		cognizable and nor	n-cognizabl	le offe	ences	, bail	able a	and n	on-bail	lable	
		offences.	:	:	:d:	:	لمسمد					
			ions related to offen itutional articles and	-		iduais	s and j	prope	rty.			
		_	cific legal areas and	-								
CO1		_	and their forms,			disti	กดูเบ๋รโ	ı civ	il an	d crin	ninal	
			ong with their practi	•			•	1 017	ii air	u Ciiii	iiiiai	
CO2			s against persons and					offens	es uno	der rele	vant	
		_	ith their practical as			_						
CO3		Apply knowledg	ge of evidence and	rules of re	levano	cy, in	cludii	ng the	e exar	ninatio	n of	
		witnesses and ex	pert testimony.									
CO4		Demonstrate an	understanding of co	nstitutional	articl	es an	d acts	s, suc	h as tl	he Nar	cotic	
		Drugs and Psychotropic Substances Act along with their practical aspects in real cases.										
CO5		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.										
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Unit-		Conte	ent	Contact		Lear	ning	Outco	ome		KL	
Unit- No.	Defi	Conte		Contact Hour							KL	
		Conte	of offence. Case		Defi	ne o	ffence	s, un	ome idersta		KL	
	class	Conte	of offence. Case		Defi	ne o		s, un			KL	
	class fund	nition and forms sification: civil as amental component	of offence. Case		Defi	ne o	ffence	s, un			KL	
	class fund legis	nition and forms sification: civil as amental component	of offence. Case nd criminal. The ents of criminal		Defi	ne o	ffence	s, un			KL	
No.	class fund legis syste	Contention and forms sification: civil as amental componentation. Constitution hierarchy.	of offence. Case nd criminal. The ents of criminal	Hour	Defi	ne o	ffence	s, un		and		
	class fund legis syste Cogn	Contention and forms sification: civil an amental componentation. Constitution hierarchy.	of offence. Case nd criminal. The ents of criminal ion and judicial		Defi	ne o	ffence	s, un		and	<b>KL</b> 1,2	
No.	class fund legis syste Cogn unde Baila	Contention and forms sification: civil at amental componentation. Constitution hierarchy. Initiable and non-content the Criminal able and non-bailation.	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences Procedure Code. ble offences under	Hour	Defi	ne o	ffence	s, un		and		
No.	class fund legis syste Cogn unde Baila the	nition and forms sification: civil an amental componentation. Constitution hierarchy. The control of the Criminal able and non-bailad Criminal Procedure.	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable	Hour	Defi	ne o	ffence	s, un		and		
No.	class fund legis syste Cogn unde Baila the C	Contention and forms sification: civil an amental componentation. Constitution hierarchy. Initiable and non-content the Criminal able and non-bailad Criminal Procedure.	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under the Code. Bailable ences, as well as	Hour	Defi	ne o	ffence	s, un		and		
No.	class fund legis syste Cogn unde Baila the (	Contention and forms sification: civil an amental componentation. Constitution hierarchy. The Criminal able and non-bailad Criminal Procedure pertinent laws	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable	Hour	Defi	ne o	ffence	s, un		and		
No.	class fund legis syste Cogn unde Baila the ( and other throu	Contention and forms sification: civil an amental componentation. Constitution hierarchy. In the Criminal able and non-bailad Criminal Procedure non-bailable offer pertinent laws agh 293.	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable ences, as well as s. Sections 291	Hour	Defi	ne o	ffence	es, un	dersta	and		
No.	class fund legis syste Cognunder Baila the Cand other throu	contention and forms sification: civil an amental componentation. Constitution hierarchy. Initiable and non-coer the Criminal able and non-bailad Criminal Procedur non-bailable offer pertinent laws agh 293.	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable ences, as well as s. Sections 291	Hour	Defi case	ne or class	ffence ificati	es, union	dersta	and		
No.	class fund legis syste Cognunde Baila the Cand other throu	nition and forms sification: civil an amental componentation. Constitution hierarchy. The Criminal able and non-bailant Criminal Procedure non-bailable offer pertinent laws 1293.  Inces against person 302, 304, 304A, 3	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable ences, as well as s. Sections 291 on-Sections, 299, 304B, 306, 307,	Hour	Defi case	ne or class	ffence	es, union	dersta	and		
No.	class fund legis system Cognunder Baila the Cand other through	contention and forms offication: civil and amental componentation. Constitution hierarchy. Initiable and non-coor the Criminal able and non-bailad Criminal Procedur non-bailable offer pertinent laws agh 293.  Inces against person 302, 304, 304A, 3320, 325, 359, 36	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under the Code. Bailable ences, as well as s. Sections 291 on-Sections, 299, 304B, 306, 307, 2, 363. Section	Hour	Defi case	ne or class	ffence ificati	es, union	dersta	and		
No.	class fund legis syste Cognunder Baila the Cand other throught of the Cand of	nition and forms sification: civil an amental componentation. Constitution hierarchy. The Criminal able and non-bailar Criminal Procedure non-bailable offer pertinent laws 1302, 304, 304A, 3320, 325, 359, 36 & 376 and their ar	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under re Code. Bailable ences, as well as s. Sections 291 on-Sections, 299, 304B, 306, 307, 2, 363. Section mendments.	Hour	Defi case	ne or class	ffence ificati	es, union	dersta	and		
No.	class fund legis system Cognunder Baila the Cand other through 300, 319, 375 Offer	nition and forms sification: civil an amental componentation. Constitution hierarchy. Initiable and non-coor the Criminal able and non-bailad Criminal Procedum non-bailable offer pertinent laws agh 293.  Inces against person 302, 304, 304A, 3320, 325, 359, 368 & 376 and their armices against proper	of offence. Case and criminal. The ents of criminal ion and judicial organizable offences. Procedure Code. ble offences under the Code. Bailable ences, as well as as. Sections 291 on-Sections, 299, 304B, 306, 307, 2, 363. Section mendments.	Hour 5	Defi case	ne or class	ffence ificati	es, union	dersta	and	1,2	
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No.	class fund legis syste Cognunder Baila the Cand other through	nition and forms sification: civil an amental componentation. Constitution hierarchy. Initiable and non-coor the Criminal able and non-bailad Criminal Procedum non-bailable offer pertinent laws agh 293.  Inces against person 302, 304, 304A, 3320, 325, 359, 368 & 376 and their armices against proper	of offence. Case and criminal. The ents of criminal ion and judicial ognizable offences. Procedure Code. ble offences under the Code. Bailable ences, as well as s. Sections 291 on-Sections, 299, 304B, 306, 307, 2, 363. Section mendments. erty- Sections 5, 415, 420, 441,	Hour 5	Defi case	ne or class	ffence ificati	es, union	dersta	and	1,2	

	<u> </u>		Γ~	1
Ш	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	<ol> <li>To prepare a schedule of five cognizable and non-cognizable crimes.</li> <li>To study crime scene in which accused was punished under charges of section 302.</li> <li>To study crime scene in which accused was punished under charges of section 375.</li> <li>To cite a case under section 14 of the constitution of India where Right to equality before law was allegedly violated.</li> <li>To study a case in which Drugs and cosmetic act was invoked.</li> <li>To study a case in which arms act was invoked</li> </ol>	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

			SEMES	STER – I								
Course	Title		E	lementary	English							
Course	code	23UBPD112R	Total credits: 2	2 1	_ T	P	S	R	O/F	C		
			Total hours: 60	0P (	0	4	0	0	0	2		
Pre-req	uisite	Nil	Co-requisi	ite			Nil			•		
Prograi	mme	Bachelor of Science in Forensic Science										
Semeste	er	Fall/I Semester of First year of the programme										
Course		1. To enable students to identify and use parts of speech, articles, auxiliary verbs, and										
Objecti	ves	construct affirmative and negative sentences.										
		2.To master advar	2. To master advanced grammar concepts: Enable students to use determiners, construct									
		various types of	sentences, and u	nderstand o	legrees of	comp	arison.					
		3.To develop spea	aking skills: Enab	ole students	to introd	uce the	emselve	es, use o	correct			
		pronunciation, i	ntonation, and str	ress, and ef	fectively	ask and	d offer	informa	ation.			
CC	)1	Equip students to	recognize and app	ply parts of	speech, a	rticles	, and at	ıxiliary	verbs,	and		
		to create both affir	mative and negat	tive sentend	es.							
CO	2	Teach students to	apply determiner	s, form diff	erent type	es of se	entence	s, and c	omprel	hend		
		degrees of compar	rison.									
CO	3	Prepare students to	•				_		on,			
		intonation, and stre		•								
CO	<b>1</b> 4	Help students gras								on		
			types, manage both formal and informal communication, and identify barriers to									
		effective communi										
CO	)5	Teach students the key components of an effective presentation and how to use visual										
		aids proficiently.			_				1			
Unit-		Contact										
		Content			Le	arning	Outco	ome	K	L		
No.		Content		Hour			g Outco			TL		
		s of Grammar (Fli			Student	s will	demon	strate a		IL		
	classr	s of Grammar (Fli			Student	ts will ental u	demon:	strate a		L		
	i. Pa	s of Grammar (Flicoom) rts of Speech			Student	ts will ental u	demon:	strate a	of	2, 3		
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No.	i. Pa ii. Ar iii. Au	s of Grammar (Flictom) rts of Speech ticles exiliary Verbs	ipped	Hour	Student	ts will ental u	demon:	strate a	of			
No.	i. Pa ii. Ar iii. Au iv. Af	s of Grammar (Flictorm) rts of Speech ticles exiliary Verbs firmative and Nega	ipped tive Sentences	Hour	Student fundam gramm	ts will lental u	demons understa	strate a anding	of			
No.	i. Pa ii. Ar iii. Au iv. Af Gran	s of Grammar (Flictoom)  In the second strict of Speech strictes and Second strict of Speech strict of Speec	ipped tive Sentences	Hour	Student fundam gramma	as will aental u	demons indersta s.	strate a anding	of			
No.	i. Pa ii. Ar iii. Au iv. Af Gran i. De	s of Grammar (Flictom) rts of Speech ticles exiliary Verbs firmative and Nega amar (Flipped clast terminers	tive Sentences	Hour	Student gramm:  Student gramm:	es will aental usar rules	demonsunderstass.	strate a anding	of			
No.	i. Par ii. Ar iii. Au iv. Af Gran i. De ii. Se	s of Grammar (Flictoom) rts of Speech ticles exiliary Verbs firmative and Nega emar (Flipped clast terminers intence Construction	tive Sentences (stroom)	Hour	Student fundam gramma	es will aental usar rules	demonsunderstass.	strate a anding	of 1,2			
No.	i. Par ii. Ar iii. Au iv. Af Gran i. De ii. Se iii. Ty	s of Grammar (Flictoom) rts of Speech ticles exiliary Verbs firmative and Nega emar (Flipped class terminers intence Construction pes of Sentences (A	tive Sentences (stroom)	Hour 6	Student gramm:  Student gramm:	es will aental usar rules	demonsunderstass.	strate a anding	of 1,2	2, 3		
No.	i. Par ii. Ar iii. Au iv. Af Gran i. De ii. Se iii. Ty	s of Grammar (Flictoom) rts of Speech ticles exiliary Verbs firmative and Nega mar (Flipped clast terminers ntence Construction pes of Sentences (Apperative, etc.)	tive Sentences scroom)  Assertive,	Hour 6	Student gramm:  Student gramm:	es will aental usar rules	demonsunderstass.	strate a anding	of 1,2	2, 3		
No.	i. Par ii. Ar iii. Au iv. Af Gran i. De ii. Se iii. Ty Im iv. De	s of Grammar (Flictoom) rts of Speech ticles exiliary Verbs firmative and Nega emar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparison	tive Sentences scroom)  Assertive,	Hour 6	Student gramma  Student gramma varied s	es will a rules will as will as will atically sentence	demonsundersta	strate a anding act and s.	of 1,2	2, 3		
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No.	i. Parii. Ariii. Au iv. Af Gran i. De ii. Se iii. Ty Im iv. De Speal i. Int	s of Grammar (Flictoom) rts of Speech ticles exiliary Verbs firmative and Negal mar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparison king Skills roduction and Gree	tive Sentences sroom)  Assertive,  tings	Hour 6	Student gramma varied s	as will ar rules as will attically sentences will as will accepted the will accepted	demonsundersta	strate a anding act ext and s.	of 1,2	2, 3		
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I II	i. Pariii. Ariii. Ariii. Ariii. Ariii. Ariii. Ariii. Seriii. Ty Imiv. De Speal i. Intiii. Proiii. As	s of Grammar (Flictoom)  rts of Speech ticles exiliary Verbs firmative and Negal mar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparison king Skills roduction and Gree onunciation, Intonat king and offering in	tive Sentences sroom)  Assertive,  n etings tion, Stress	6 6	Student gramma varied s  Student introdu engage with co	as will as will attically sentences will ce there in basinger to the contract of the contract	demonstructure types	ently s and ersation iation.	of 1,2	2, 3		
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I II	i. Parii. Arriii. Arriii. Arriii. Beriii. Ty Im iv. De Speal i. Int iii. Pro iii. As Comi i. Int	s of Grammar (Flictoom)  rts of Speech ticles exiliary Verbs firmative and Negal mar (Flipped class terminers intence Construction pes of Sentences (A perative, etc.) gree of Comparison king Skills roduction and Gree onunciation, Intonat king and offering in munication Skills roduction to Comm	tive Sentences seroom)  Assertive,  n etings tion, Stress information	6 6	Student gramms varied s  Student introdu engage with co	as will atically sentence there in base rrect pass will nicate	demonstructure de types  constructure de types  confideres de types  con	ently and ersation iation.	of 1,2, 1,2,	2, 3		
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I II III	i. Parii. Ariii. Ariii. Ariii. Seriii. Ty Imiv. De Speal i. Intiii. As Comi i. Intiii. Pro iii. Fo iv. Un	s of Grammar (Flictoom)  rts of Speech ticles exiliary Verbs firmative and Negal mar (Flipped class terminers intence Construction pes of Sentences (Apperative, etc.) gree of Comparison 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 information communication, communication,	6 6 5	Student gramms varied s  Student introdu engage with co	as will atically sentence there in base rrect pass will nicate	demonstructure de types  constructure de types  confideres de types  con	ently and ersation iation.	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				

			SEMESTER	- I								
Course Ti	itle		Che	mistry	y <b>- 1</b>							
Course co	de	23FSCH114R	Total credits: 2	L	T	P	S	R	O/F	C		
			Total hours: 30T	2	0	0	0	0	0	2		
Pre-requi	site	Nil	Co-requisite				N	il				
Programm	ne	Bachelor of Science in Forensic Science										
Semester		Fall/ 1 nd semester of first year of the program										
Course Objectives		including van d in covalent bon 2. Explore isomer conformational associated with 3. Grasp the kinet van der Waals of 4. Comprehend the theory, wave m 5. Study periodic radii, ionization	principles of hybridizater Waals interactions, hads. ism concepts, including isomerism, and undifferent isomers. ic molecular theory of equation, as well as the equantum mechanicate echanics, quantum numproperties of elements in enthalpy, electron gain the periodic table.	g option g option dersta gases, e princi l aspecabers, a s, focus	en bor cal iso nd the devia tples g cts of and the sing o	merisme non ations to governications de electron electron effects	and ele	metric ature deal be liquef ture, in onfigu	isomerisi and properation of action of action of action of action of a charge, a	m, and perties atoms. atomic		
CO1 CO2 CO3		Understand the hy of molecules.  Identify the kinet properties of enance Explain Bohr's the	ic molecular theory of ciomers.	of gase	es, dev	viation n numl	s fron	n ideal	behavio	r, and		
CO4		Understand the periodic properties of elements, including effective nuclear charge and ionization enthalpy.										
CO5	T	electronegativity v			1					1		
Unit- No.		Conte	nt	Conta Hou		Le	arnin	g Outo	come	KL		
I	of rang delo interaction dipole heter reast Nuclei hyperaction interaction freedom interaction of range delo interaction of range delo interaction of reaction of	pridization of carbon molecules, bond leng les, bond energy, lo ocalized chemical be practions, hydrogen ds & bases, their rela- cole moment. Homole erolytic bond breaking gents-electrophiles a eleophilicity& basic placements in a cova- ductive effect, electronance effect or mes- perconjugation). Type etions & their mecha- ter radicals, carbenes, es, shapes & relative	gths and bond calized and ond, van der Waals bonding. Organic ative strengths, ytic and ng. Types of and nucleophiles. ity. Electronic alent bond omeric effect, someric effect, ses of organic anisms. Reactive ons, carbanions, and nitrenes (their	7		Under hybrid bonds	lizatio	-		1,2		

	Concept of isomerism, Types of		Grasp isomerism concepts,	
	1 7			
	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 &			
	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			
	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		Comprehend atomic	
	spectrum of hydrogen atom. Wave		_	
	, ,		spectra, wave mechanics	
	mechanics:de Broglie equation,			
	Heisenberg's Uncertainty Principle and its			
	significance, Schrödinger's wave			
IV	equation, significance of ψ and ψ. Radial	_		1,2
	and angular wave functions for hydrogen	5		
	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.			

processor volume	Detailed discussion of the following periodic properties of the elements, with 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	5	Learn periodic properties, electronegativity trend	1,2
V r. id	Waals). Ionic and crystal radii. Covalent radii. Ionization enthalpy, Successive	5		1,2

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 Raj, 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,	1					
1	electronic effects, and the shapes of molecules.	1					
2	Identify the kinetic molecular theory of gases, deviations from	1					
	ideal behavior, and properties of enantiomers.	1					
3	Explain Bohr's theory, wave mechanics, and quantum	1					
3	numbers	1					
4	Understand the periodic properties of elements, including	1, 8					
7	effective nuclear charge and ionization enthalpy.	1, 6					
5	Describe electron gain enthalpy, trends in electronegativity,	1					
3	and the variation of electronegativity with bond order.	1					

			SEMESTE	R – I								
Course Title Physics - 1												
Course	code	23FSPH115R	Total credits: 2	L	T	P	S	R	O/F		C	
			Total hours: 30T	2	0	0	0	0	0		2	
Pre-req	uisite	Nil	Co-requisite				N	il				
Progran	nme		Bachelor of Scio									
Semester Fall/ 1 nd semester of first year of the program												
Course		1. Understand scal	ar and vector quantitie	es, their	prope	erties, a	and into	erpreta	tions, in	clu	ding	
Objectiv	ves	scalar and vecto	•									
		_	ate systems, motion	concept	s, frai	mes of	refere	nce, a	nd princ	iple	es of	
		relativity.							_			
			namics, elastic prope	rties of 1	matte	r, and e	quatio	ns like	Bernou	lli's	and	
		continuity.										
			rinciples, work, cons		, rota	tional	dynan	ncs, ar	nd relati	ons	hips	
			nd angular variables.									
			ive types, calculate p	propertie	s, de	lve into	o soun	d wav	es, and	exp	lore	
GO	1	ultrasonic applic		1	• ,		1.				1 .1	
CO	1		and vector properties					ergenc	e, curi,	ana	the	
CO	•		distinction between conservative and non-conservative forces.									
	<b>4</b>	Identify the concepts of frame of reference, inertial and non-inertial frames, special theory										
CO	2	of relativity, Lorentz transformations, and relativistic addition of velocities.										
CO.	3	Explain the fundamentals of motion, acceleration, projectile motion, pseudo forces, elastic properties of matter, fluid dynamics, and equations like Bernoulli's.										
CO	1	Explain the concepts of energy, kinetic energy, work, rotational variables, and the										
CO.	•	conservation of energy, especially in rotational motion.										
CO	5	Describe different types of waves, sound waves, Doppler effect, sound intensity										
			the introduction to ult							iiici	isity	
Unit-		Conte		Contac								
No.				Hour	I		8					
	Scala	r and Vector, Prope	rties of vectors,		N	1asterii	ng vec	tors an	d			
	scala	r and vector product	, scalar and their			coordinate systems						
	interp	pretation in terms of	area and volume									
	respe	ctively, scalar and v	ector fields.									
I	Conc	epts of Cartesian an	d spherical polar	7						1	,2	
	co-01	rdinate systems, area	a, volume, velocity,	,								
	and a	cceleration in these	systems. Concepts									
		vergence and curl. C	onservative and									
		conservative forces.										
		e of reference, Inert				raspin	-	-	nd			
		e, Galilean transforn		re	eferenc	e fram	es.					
		iance, Non-Inertial										
	_	eed of light, Postula										
II		ry of Relativity, Lor	_						1	,2		
		formations, Length	5									
		on, Relativistic addi										
		-energy relation, Re										
		entum & energy, Tr	ansiormation of									
	mom	entum and energy.										

	Definition of motion, position and		Analyzing motion, forces,	
ш	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	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					

			SEMESTER -	I												
Course	Title		Biolo	ogy- 1												
Course	code	23FSBO116R Tot	al credits: 2		L	T	P	S	R	O/F	C					
		Tot	al hours: 30T		2	0	0	0	0	0	2					
Pre-re	quisite	Nil	Co-requisite					Ni	il							
Progra	mme	Ba	chelor of Science	in For	ensio	Scie	ence									
Semest	emester Fall/ 1 nd semester of first year of the program															
Course	2	1. Develop a comprehens	op a comprehensive understanding of Algae, covering general characteristics,													
Object	ives	classification, reprodu	ction, and econom	ic signi	fican	ce.										
		2. Study the fundamental aspects of fungi, including their characteristics, classification,														
		and economic importa	nce.													
		3. Explore lichens, under	standing their gen	eral fea	tures	, stru	cture	e, repi	roduct	tion, an	d					
		economic importance.														
		4. Gain insights into Bry		charact	eristi	cs, cl	assif	icatio	on, rep	roducti	ion,					
		and economic relevance														
		5. Examine Pteridophyte	-						_							
		economic importance.			_	cal co	ncep	ots su	ch as	ecosyst	ems,					
			geochemical cycles, and succession.													
C	01		Understand the general characteristics, classification, modes of reproduction, and													
	22	economic significance of														
CO			l features, classification of fungi, and their economic importance. general aspects, structure, reproduction, and economic significance of													
CO	<b>J3</b>	-	aspects, structure	, reprod	luctic	n, an	d ec	onom	ic sigi	nificano	ce of					
	24	lichens														
CO	<b>J</b> 4	Identify the general characteristics, classification, modes of reproduction, and economic														
CO	75	importance of bryophytes  Identify the concept of ecosystems, their structure and function, energy flow,														
	<i>J</i> 5	biogeochemical cycles, an	<u> </u>			and	a iu	пспо	n, en	ergy i	iow,					
Unit-		Content	Contact	uccessi		rnin	<u>π Ωυ</u>	tcom	ΙΔ		KL					
No.		Content	Hour		Lta	1 11111	g Ou	ittoiii	ic	1	XL					
<u>I</u>	Algae.	General account of Algae,		Identi	ify cl	accec	unc	lersta	nd							
_	_	s of algae. Reproduction, o			•				110	1,						
		Economic importance of alg		_	roduction, economic portance.											
II	Ū	General account of fungi		Class			liche	n: gra	asp							
	_	of different classes of fung		econo												
	_	mic importance fungi.														
	LICHE	EN: General account of lich	en, 5							-	1,2					
	structu	re and reproduction,														
	Econo	mic importance Lichen.														
III	Bryopl	nytes: General account of		Diffe	rentia	te cl	asses	s, und	erstan	ıd						
	Bryopl	nytes, Study of different		repro	ducti	on, e	colog	gical 1	role							
	classes	of Bryophytes,	8							-	1,2					
	Reproduction, Economic importance															
	bryophytes.															
IV		Pteridophytes: General account of Classify pteridophytes,														
		ophytes, Study of different		under		_										
		of Pteridophytes,	5	ecolo	gical	signi	fica	nce		1,2						
	_	luction, Economic importa	nce													
	Pterido	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	1
1	of reproduction, and economic significance of algae.	1
2	Identify the general features, classification of fungi, and their	1
	economic importance.	1
3	Understand of the general aspects, structure, reproduction,	1
3	and economic significance of lichens	1
4	Identify the general characteristics, classification, modes of	1
-	reproduction, and economic importance of bryophytes.	1
	Identify the concept of ecosystems, their structure and	
5	function, energy flow, biogeochemical cycles, and the	1
	process of succession.	

	SEMESTER – II															
Course T	itle			Foren	sic P	hysics										
Course c	ode	23BSFS121R	Total credits: 4		L	T	P	S	R	O/F	С					
			Total hours: 45T	+30P	3	0	2	0	0	0	4					
Pre-requ	isite	Nil	Co-requisite	)				Nil		I	1					
Program	me		Bachelor o		ce in	Forens	ic Scie	nce								
Semester		Fall/ II semester of first year of the programme														
Course		1. Understand and apply principles of impression evidence analysis, including tyre														
Objectiv	es		marks, serial numb		•			•			- •					
		2. Identify, classify, and analyze tool marks, emphasizing class and individual														
			characteristics, tracing, lifting, and photographic examination.  3. Examine glass properties, including composition, fractures, and direction of impact,													
			soil examinations b													
		analysis.	son examinations t	asca o	ii coic	n, acrisi	iy, sizc	uistiio	ution,	and che	iiiicai					
		•	es of paints, cond	luct m	icrosc	opic an	d mac	roscop	ic stuc	lies, ar	nalyze					
			ribution, and perfor		•	_					·					
			hair structure, colle					•	fibers	s, condu	acting					
CO1	<u> </u>		, physical, chemica						4 4	- C C-						
CO	L		nalyze various imp	pressio	n evi	dence t	ypes 11	n the c	context	OI IO	rensic					
CO2	<u> </u>	Ū	investigations.													
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														
COS			through comprehensive examinations along with their practical aspects.													
CO4	Į.		ency in forensic pa							natchin	o and					
		chemical analy	•	unit CA	ammi	<i>.</i>	neraan	is pily	sicai ii	iacini	g and					
COS		•	ompetence in hair a	nd fibe	r ana	lysis, pr	oviding	valua	ble cor	ntributio	ons to					
			gations involving these types of physical evidence along with													
		practical aspect	0		<b>J</b> 1	1 3										
Unit-		Conte		Cont	act	L	earnin	g Outo	come		KL					
No.				Hou	ır			Ü								
	Impr	ession evidence:	types of			Underst	and the	e Impo	rtance	of						
I	impr	ession evidence,	tyre marks, skid	8		impress	ion ma	rks in v	vehicul	ar	1.2					
1	mark	s, serial number	restoration,			acciden	t cases				1,2					
	vehic	cular accident														
	Tool	marks evidence	types of tool			Elucidate the use of tool mark										
	mark	s, class and indi	vidual			their res	storatio	n and r	nethod	of						
II	chara	acteristics, tracin	g and lifting of	7		recordir	ng thos	e restoi	ed ma	rks.	1,2					
11	mark	s, photographic	examination of	,							1,2					
	tool	marks. method o	f making-cast,													
	meth	ods of obliteration	on and restoration													
		s: types and their	-			Mastery	of gla	ss exar	ninatio	n						
	dete	rmination of dire	ction of impact,													
			n of glass: colour,													
	fluor	escence, physica	al matching,													
III		ity comparison,		10							1,2					
		examination of	•													
		distribution of so	-													
			chemical analysis													
	of so	il														

IV	Paints: types of paint and their composition, forensic examination of paints: microscopic and macroscopic studies-pigment distribution, microchemical analysis, physical matching, solubility test, pyrolysis gas	10	Competence in paints examination	1,2
V	chromatography  Hair: structure of human and animal hair. examination of hair, location, collection, evaluation;  Fibers: classification, microscopic, physical and chemical, instrumental examination of fibers.	10	Grass fiber, hair morphology, tool marks	1,2
Practical	<ol> <li>To analyze density of glass</li> <li>To analyze refractive index of glass</li> <li>To analyze density of soil</li> <li>To analyze hair</li> <li>To analyze types of glass their composition, their macroscopic and microscopic properties.</li> <li>To analyze Hair and fibers, their composition, their macroscopic and microscopic analysis</li> <li>To identify tool marks, their restoration and method of recording those restored marks.</li> </ol>	30		1,2,3,

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
2	context of forensic investigations.  Apply techniques for making casts, and obliteration and restoration methods, showcasing competence in tool mark analysis.	1, 2
3	Demonstrate expertise in glass and soil analysis, contributing to forensic investigations through comprehensive examinations along with their practical aspects.	1, 3
4	Exhibit proficiency in forensic paint examinations, including physical matching and chemical analyses.	1, 3
5	Demonstrate competence in hair and fiber analysis, providing valuable contributions to forensic investigations involving these types of physical evidence along with their practical aspects.	1, 3

	SEMESTER – II												
Course Ti	itle			Forensic Psychology redits: 3									
Course co	ode	23BSFS122R	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					
Programi	ne		Bachelor of Sci										
Semester			inter/ II semester			r of the	prog	ramm	e				
Course	~		ethics, and expert wi			al la a al41	L						
Objective	S	<ol> <li>Analyze causes, impact, bystander effect, mental health.</li> <li>Study profiling, testimony, competence, treatment, special populations.</li> </ol>											
		<ol> <li>Study profiting, testimony, competence, treatment, special populations.</li> <li>Learn tests, detection methods, lie detection, applications.</li> </ol>											
		<ul><li>4. Learn tests, detection methods, he detection, applications.</li><li>5. Develop competences, interviewing skills, legal role, psychotherapy practices</li></ul>											
CO1			ure, history, and sco								s role		
		from traditional psy		1		1 3		<b>.</b>	U	υ			
CO2			and analyze the im	pact of	f crim	ne on vi	ctims,	explo	ring v	ictimiz	ation		
			cing it, such as the b										
CO3			riminal profiling, fac										
		_	e roles of correction	al psy	cholo	gists al	ong w	ith the	ir pract	ical as	pects		
004		using real life crim		.:	41 1	<b>f</b> o '	1	40-4	. ! 1	11:	D !		
CO4			ical tests and forens on Signature Profili										
			on Signature Profifi cts using real life cri	_			uetec	uon m	cmods	arong	with		
CO5			sic consultancy and				nhasiz	ing co	ore co	mneter	ncies		
000			ing techniques, and								10105,		
Unit-		Conte		Con		L		KL					
No.				Ho	ur			Ü					
	Int	roduction to forensic	Psychology,			Understand forensic							
	Nat	ure, History and its S			psycho	ology'	s scop	e, ethic	cs.				
	Fun	damental distinction											
I	Psy	Psychology and Law, Police Psychology,									1,2		
	For	ensic Psychology in											
		ds. Ethical and legal											
		ctice, Psychologist a											
		ne: Causes, impact of	_			Analy	ze crir	ne cau	ses. vi	ctim			
		timization, Factors a				impaci			~~,				
		imization: Bystande	C			•							
II		ntal Health. Psychological		7	,						1,2		
11		pecific crime types:	•	<b>'</b>							1,2		
		nicides, sexual offen											
		bery, theft, white col											
		•				Study	nrofil:	ing co	mpeta	nce			
		<b>U</b> • •	•			-	_	-	mpete	iice,			
		_				231100		10100					
***											1.0		
111				8							1,2		
		Risk Assessment, Treatment of Special											
						·		1		.1 4			
		•							on me	thods,			
		•			lie detection								
IV				5							1,2		
	_												
		co-analysis.	-Tr0,										
IV	Correction Correction Rehibition Residual Priss Psylofic Correction Correction Rehibition Rehibitio	ulation: Violent Offeroners, Juvenile Justive Chological Tests used chology, Forensic mature Brain Electricanature Profiling (BE ections: Polygraph, 1	al, Roles of st, Treatment and tional facilities, ment of Special enders, Women ce. ed in forensic ethods in detection al Oscillation OS). Lie	5		Learn lie det	tests,	roles					

V	Forensic consultancy and supervision, core competences, Cognitive interviewing 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	5	Develop consultation skills, legal interaction	1,2
Practical	<ol> <li>To review a crime case involving serial murders. Remark on the accused's psychological traits.</li> <li>To compile a report on the connection between forensic psychology and mental disorders.</li> <li>To examine a criminal case in which deception was found using hypnosis.</li> <li>To review a criminal case involving serial murder</li> <li>To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.</li> <li>To provide an example of a criminal case where narco analysis was employed to uncover deceit</li> </ol>	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	r In	press	ions		_				
Course co	de	23BSFS123R	Total credits: 4		L	T	P	S	R	O/F	C		
			Total hours: 45T+30	0P (	3	0	2	0	0	0	4		
Pre-requi	site	Nil	Co-requisite					Nil					
Programm	ne		Bachelor of Scien	ice in I	Fore	ensic S	Scienc	e					
Semester		Winter/ II semester of first year of the programme											
Course			historical developmen			_			_		<b>.</b> .		
Objectives	S	2. Analyze and interpret fingerprint patterns, ridge characters, and minutiae.											
		3. Explore the classification and cataloging of fingerprint records, including the use of											
		automated syste											
		-	constituents of sweat i	residue	anc	l empl	loy va	rious 1	nethoo	ds for l	atent		
		fingerprint dete											
		-	constituents of sweat	residue	anc	i empl	loy va	rious i	nethoo	ds for I	atent		
001		fingerprint dete				C C*		. ,•					
CO1		)	nistorical facts and bas		•		•		1	1' CC			
CO2		•	gerprint patterns, inclu- ound at crime scenes al	_	_					aittere	ntiate		
CO3		• • • •	on and cataloging of fi			•		•		tad arva	toma		
003		•	~ ~	•				_		•			
		aspects.	nd understand the significance of poroscopy and edgeoscopy along with their practical										
CO4		Analyze and interpret latent fingerprints through physical and chemical methods,											
		preservation, and lifting, including digital imaging techniques along with their practical											
		aspects.	g,g @.g				4000 0		, 1011 011	pru.			
CO5		•	rtance of footprints ca	sting t	echi	niques	, elec	trostati	ic lifti	ng of	latent		
		footprints, and understand the historical significance of palm prints and lip prints along											
		with their practical	aspects.				_			_	<b>T7T</b>		
Unit-		Cont	ent	Conta	act	]	Learn	ing O	utcom	e	KL		
No.				Hou	ır								
			y. Biological basis of					ding fi		rint			
I		gerprints. Formation	•	8	8 history and formation.				1,2				
		damental principles	· · · ·										
		gerprint patterns. Ri	•				-	_	rprint p	pattern			
		racters/minutiae. Pla		_		and	minuti	iae.					
II	_	gerprints. Ridge Trac	-	7							1,2		
		inting. Types of Fin	gerprints found at										
		me Scene.	· · · 6 6 · · · · · · ·			Class	-: C - C:			. 1			
			oguing of fingerprint				-	ngerpr		ia use			
III		tem. Significance of	gerprint Identification	10		iden	uncau	ion sys	stems.		1.2		
111	-	-	Classification. Single	10							1,2		
	_	it Classification.	Classification. Single										
	,	istituents of sweat re	esidue. Latent			Dete	ect pre	eserve,	and				
		gerprints' detection b					_	ngerpr					
	_	_	ervation and lifting of				11	-0P1					
IV		eloped fingerprints.	-	10							1,2		
			t. Fingerprinting the	_,							,-		
	_	eased											

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

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

	SEMESTER – II											
Course	Title			PLICIT EN			1	1		1		
Course	code	23UBPD122R	Total credits: 2	L	T	P	S	R	O/F	C		
Pre-req	nicito	Nil	Total hours: 60P Co-requisite	0	0	4	0 Nil	0	0	2		
Program		INII	Bachelor of	Science in I	Torone	ic Sci						
Semeste												
Bellieste	/1	Winter/II Semester of First year of the programme  1. To equip students with the skills to interchange sentence types, use various tenses, and										
			on grammatical error		e sente	nee ty	pes, a	se var	ious tem	ses, and		
Course			lents to effectively u		l substi	itution	s, und	lerstan	d homo	nyms		
Objecti	ves	and homophones, avoid commonly confused words, and use idioms and phrases.										
		3. To help students understand the nature and types of listening, and overcome barriers to										
		effective lister	~									
CO	1		with the ability to t		ntence	types,	utiliz	e diffe	rent ten	ses, and		
			n grammatical mistal		1 1			20				
CO	,		nts to proficiently ap									
CO	<u> </u>	•	homophones, avoid	rrequently co	onruse	u wor	us, an	u mcoi	porate 1	aioms		
		and phrases in the	n comprehending the	e various as	nects a	nd typ	es of	listenii	no and	in		
CO	3		overcoming obstacle				CS OI	113101111	ing, and	111		
~~	_						extrac	ting re	levant			
CO	4		Facilitate students in employing effective reading strategies, extracting relevant information from texts, and utilizing the SQ3R method.									
CO	5	instruct students on the significance of time management and provide foundational										
			nage their time effici									
CO	6	Lead students in	creating a well-roun		ofessio	nal Li	nkedI	n profi	le.	1		
Unit- No.		Conte	ent	Contact Hour		Learı	ning (	Outcon	ne	KL		
	Gran	nmar (flipped cla	assroom)		Stud							
		erchange of Interr			construct and transform various sentence types and correct grammatical errors.							
I		tive Sentences, E	xclamatory and	6						1,2, 3		
_		tive Sentences								1,2, 3		
		pes of Tenses										
		ommon Errors bulary Developn	nont		Stud	onte x	rill onl	nance 1	hair			
		word substitution	iieiit									
II		onyms and Homo	nhones	6	vocabulary and use words accurately in context.					1,2, 3		
		ls often confused	priories							1,2,0		
		ns and phrases										
		ning Skills						monstr				
III		at is listening?		5				g skill		1,2, 3		
111		pes of Listening			ident	ify lis	tening	g barrie	ers.	1,2,3		
		nderstanding List	ening Barriers		G. 1		*11	1 00	• ,1			
		ing Skills	iva Daadie -			ents w extract		d effic	eiently			
IV		chniques of Effect	information from	5				ant g the S	CO3D	1,2, 3		
1 4	a text	-	IIIOIIIIatioii IIOIII	3		iique.	ii usiii	guie	NCOK	1,2, 3		
		ne SQ3R Techniq	ue		teem	nque.						
		-Management S			Stud	ents w	ill eff	ectivel	y			
		oduction to Time						e usin	-			
V		rpose and Importa		4		us str			-	1,2, 3		
		gement										
	iii. Ba	asic Tips to Main	tain Time		<u> </u>							
VI	Crea	tion of LinkedIn	Profile	6		ents w			011	2, 3		
				professional LinkedIn profile.								

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					

			SEM	ESTER – 1	II							
Course	Title			Environm	ental Sc	ienc	e					
Course	code	23BSFS127R	Total cre			<u>L</u>	T	P	S	R	O/F	C
				ours: 30T			0	0	0	0	0	2
Pre-rec		Nil		o-requisite					Ni	il		
Progra				or of Science								
Semest				nester of F								
Course		1. To prepare student						_			•	ıplex
Object	ives	environmental issu		-			_			_		
		2. To develop a worl										nment
		and its associated	•				_					4:
		motivations and co				-	a col	iecti	very	lowa	ras son	utions
		of current problem 3. To gain knowledg	_				rcitz	, and	ito ir	nnor	tonco	
	01	The students will be										
	.01	context of environme										e l
	O2	Students will learn al									•	
	.02	of Humanactivities o			nts impo	ı tanı	c an	u ciiv	11011	inciit	ai iiip	acts
C	03	Gain knowledge above			cosystem	ı. Stu	ıdent	s wil	1 be a	able t	0	
		understand the conce			-					.010 .		
C	04	Gain knowledge about the conservation of biodiversity and its importance.										
C	O5	Aware students about problems of environmental pollution, its impact on human and										
		ecosystem and control	•		•				•			
Unit-		Content		Contact		Lea	rnin	g Ou	tcom	ıe		KL
No.	N/I14: J:			Hour	Learning Outcome  Environmental studies combines							
		sciplinary nature of umental studies: Defir	ition		science							
		nd importance, Need for	,			ai						
I	awarene	-	or public	4		issues. Its multidisciplinary approach is key to solving complex 1						
1	awarche	233.		7	problen		-		_		_	1,2
					educati							
					sustaina				Pro		-5	
	Natura	Resources: Renewal	ole and		Natural		•	s, bo	th re	newa	ble	
		newable resources, Na			and nor							
	resource	es and associated probl	ems.		exploita	ation	issu	es, ir	ıclud	ing		
	Forest r	esources: Use and over	r-		defores	tatio	n, ov	erus	e of v	vater		
	exploita	tion, deforestation, cas		resourc	es, e	nviro	onme	ntal				
II	studies.	tudies. Timber extraction, mining,			challen	ges v	es with minerals and food				1,2	
11	dams an	nd their effects on fores	st and	6	and lan	d de	grada	ation	Indi	vidu	als	1,2
	tribal pe	eople. Water resources	: Use and		play a c	cruci	al ro	le in	conse	ervin	g	
		lization of surface and	_		resourc		_	omot	ing			
		loods, drought, conflic			sustaina	abilit	y.					
		ams-benefits and prob	lems.									
	Mıneral	resources: Use and										

	exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case 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  Ecosystems: Concept of an ecosystem.		This module covers ecosystems,	
III	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, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	4	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	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. 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 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

	Environmental Pollution: Definition	I	T	1
V	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 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.	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
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

	Field work: Visit to a local area to		Fieldwork objectives include	
	document environmental assets		documenting environmental assets	
	river/forest/grassland/hill/mountain.		like rivers and forests, assessing	
	Visit to a local polluted site-		pollution in urban or rural sites,	
VIII	Jrban/Rural/Industrial/Agricultural.	5	and studying local biodiversity and	1.2
V 111	Study of common plants, insects, birds.	5	ecosystems such as ponds and hill	1,2
	Study of simple ecosystems-pond, river,		slopes	
	hill slopes, etc.			
	(Field work Equal to 5 lecture			
	hours)			

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	Chemis		,							
Course code   23FSCH124R   Total credits: 3   L   T						S	R	O/F	(	C	
		Total hours: 30T + 30P	2	0	2	0	0	0		3	
Pre-requisi	ite Nil	Co-requisite			ı	Nil					
Programm	ie	Bachelor of Science	in For	ensic	Scien	ce					
Semester		Winter/ 2 nd semester of fi	irst ye	ar of	the pr	ogran	1				
Course	1. Understand the	e principles of isomerism, in	ncludir	ng its	source	s, met	hods o	of form	atic	on,	
Objectives		and chemical properties of	alkane	es, all	kenes,	and al	kynes	, along	W	ith	
	mechanisms in		4		111_1	.1:1	1	1 1	11.1		
	_	ormation and chemical reaucleophilic substitution reau			•			aryi na	11106	es,	
		ersible and reversible reacti						law of	ma	ass	
		thermodynamic treatment			_						
		nto various types of chemic							eori	ies	
		theory, Valence Bond theor	•					•	l <b>4</b>	4 1	
		cid-base reactions throughing solvents, Lewis acid-base									
	_	l Bases (HSAB) principle.	,c conc	ρι, <i>ι</i>	ara ure	արիու	outiOII	or Hal	ua	,11U	
CO1		verse isomerism and master	ring the	e phy	sical ar	d che	mical j	propert	ies	of	
		alkynes, and aromatic comp									
CO2		Interpret in handling the methods of formation, reactions, and mechanisms involved in									
CO3	alkyl and aryl hal	equilibrium principles, Le	Chateli	ier's r	rincinl	e and	their	annlica	tio	ne	
CO4		bonding, structure, and 1									
	molecular orbital	•	<i>J</i>		1	1					
CO5		ion of acid-base concepts, i		_		-Low	ry, Le	wis the	ori	es,	
Unit-No.	1	Soft Acids and Bases (HSA ontent		ncipl ntact		min	· Out	20722	T/	KL	
Unit-No.		ontent		our	Le	arımış	g Out	come	ı	XL	
	Isomerism, sources, r	nethods of formation,			Mas	ter hy	droca	rbon			
		nd chemical reactions of				-	, react				
	alkanes, alkenes, alky	rnes along with the			aror	naticit	y				
	mechanism involved.	Saytzeff's rule, Hofmann									
	elimination, Markow	nikoff's rule,									
	Antimarkownikoff's 1	rule. Dienes and their									
	classification: isolated										
I	cumulated dienes. Str		7	7					1	1,2	
		er reaction. Aromaticity,									
	· ·	cic character of arenes,									
	•	arbanions & Pheterocyclic									
	compounds with suita	•									
	· · · · · · · · · · · · · · · · · · ·	aromaticity; Preparation,									
	physical and chemica	properties of arenes									
	(especially benzene).	a, chemical reactions of			IInd	areter	d hali	do			
		halides. Mechanisms of					ia nan , react				
	nucleophilic substitut					iauon hanisi		10118,			
II	_	mechanism. Nucleophilic	4	5	IIICC	11411151	115.		1	1,2	
11		the addition elimination	•						1	.,_	
		dditional mechanisms of									
		substitution reactions									

Ш	Irreversible & reversible reactions, chemical equilibrium, law of mass action, thermodynamic treatment of law of mass 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.	8	Grasp equilibrium principles, Le Chatelier's principle	1,2
IV	Types of bonds: lonic bond, Covalent bond and Co-ordinate bonds. Oxidation number. Lewis theory, Formal charge, Valence Bond theory, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), Bent's rule, Molecular orbital theory. Molecular 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.	5	Comprehend bond types, hybridization, molecular orbitals.	1,2
V	Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB). Application of HSAB principle	5	Master acid-base concepts, Lewis theory.	1,2
Practical	<ul> <li>1.Qualitative analysis of inorganic salts.</li> <li>Cations: Pb²+, Cu²+ As³+, Aℓ³+, Fe³+, Mn²+, Zn²+, Ni²+, Ca²+, Sr²+, Ba²+, Mg²+</li> <li>Anions: (CO₃)²-, S²-, (SO₃)²-, (NO₂)-, (SO₄)²-, Cℓ⁻, Br⁻, I⁻, (PO₄)³-, (C₂O₄)²-, CH₃COO⁻, NO₃=</li> <li>2.Qualitative organic analysis.</li> <li>Detection of elements (N, S, Halogens)</li> <li>Detection of organic functional groups</li> <li>(-COOH, PhOH, -CHO, =CO, -OH, -NO₂, -NH₂</li> </ul>	30		1,2, 3,4

**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	Ι							
Course Ti	itle		Phys	ics- 2							
Course coo	de	23FSPH125R	Total credits: 3		L	T	P	S	R	O/F	C
			Total hours: 30T + 30F	•	2	0	2	0	0	0	3
Pre-requis	site	Nil	Co-requisite					Nil			
Programm	1e		Bachelor of Science	in Fore	ensio	Scie	nce				
Semester			Winter/ 2 nd semester of t	first yea	r of	the p	rogra	am			
Course		*	fields, Gauss' Law, and con								
Objectives			arization, dielectric effects			•					
		C	ic fields, calculate forces,	•		_			tions		
			zation, susceptibility, and f	-							
	5	-	ctromagnetic induction, N	Iaxwell'	's E	quatio	ns, a	nd cii	cuit	pheno	mena
		like resonance.									
CO1			ntal electrostatic concepts							Law,	and
CO2			ving them to charge distrib ic fields in matter, polari							effecti	velv
002			Law in dielectrics	eation, a	aria ,	arcicc	ше р	горсг	1105,	ciiccti	very
CO3			oply magnetic forces, Biot	-Savart'	s La	w, Ar	npere	's Cir	cuita	l Law,	and
	_	_	magnetic field to calcul	ate forc	es a	and to	orques	in c	urrei	nt-carr	ying
CO4		ystems.	ation, magnetic intensity,	anaaant	::L:1:		d nor	a a b	.:1:4	ov.mlo	i
CO4			ation, magnetic intensity, nd understanding the B-H	•		•	-	meau	mity,	explo	ning
CO5		Demonstrate proficiency in electromagnetic induction principles, including Faraday's									
		Law, Lenz's Law, and an introduction to Maxwell's Equations, applying them to AC									
T1 */ N1	c		e, and power dissipation		4	_	•	0 4			7.1
Unit-No.		Co	ontent	Conta Hou		Learning Outcome		ľ	KL		
	Flect	tric field. Electric	field lines. Electric flux.	11001		Grası	n elec	troeta	tice		
		•	ications to charge			and C					
			erical, cylindrical and			ana	Jauss	Law	•		
		-	nservative nature of								
I	_	•	ectrostatic Potential.	_						1	1,2
	Lapla	ace's and Poisson	equations. Potential and	7							,
	Elect	tric Field of a dip	ole. Force and Torque on								
	a dip	ole. Capacitanc	e of a system of								
	charg	ged conductors.	Parallel-plate capacitor.								
	Elect	tric Field in matte	er. Polarization,			Unde	rstan	d			
		-	Electrical Susceptibility	Electrical Susceptibility			izatio	n and	[		
II			t. Capacitor (parallel			diele	ctrics			1	1,2
	_		drical) filled with	5							-,-
			ent vector D. Relations								
			Gauss' Law in dielectrics			~ .					
	_		een current elements and			Calcu		-			
		nition of Magnetic			force	s and	nelds	S			
			plications: straight wire								
TTT		-	npere's Circuital Law and							1	
III	_	-	noid. Properties of B	8							1,2
	_	· · · · · · · · · · · · · · · · · · ·	netic Force on point g wire between current								
		•	a current loop in a								
		orm Magnetic Fie	•								
	uIIII	nin magnetic Fie	AU.								

	Magnetization vector (M), Magnetic		Analyze	
IV	Intensity(H), Magnetic Susceptibility and		magnetization and	1,2
1 7	permeability. Relation between B, H, M.	5	magnetic materials	1,2
	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 cell			
Practical	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					

	SEMESTER – II									
<b>Course Tit</b>	le		Biology	- 2						
Course cod	le 23FSBO126R	Total credits: 3		L	T	P	S	R	O/F	С
		Total hours: 30T	$\Gamma + 30P$	2	0	2	0	0	0	3
Pre-requisi	ite Nil	Co-requisit					Nil			
Programm		Bachelor of Sc								
Semester		Winter/ 2 nd semeste					gram	l		
Course	-	ciples and basis for								
Objectives		al characters, classif					-		_	-
	-	otochordates and	_	, hi	ghlight	ting	gener	al fe	atures	and
	· ·	vertebrate evolutio		0.01.1						
	_	features and classif				_		_	tiles	
001		eral features and class							• • • • •	•
CO1	_	nsion of the ration	naie ben	ına	anıma	I King	gaom	class	111cat10	on in
CO2	biological sciences	area animal alasta d	hair atau	ooto-	iatiaa	ond	, olusti -	n 0#= -	oi on: f	00000
CO2		erse animal phyla, the								
03	evolution	hordates and agna	ma char	acter	isucs	and t	neir r	oie ii	ı verte	eorate
CO4		aptations, parental c	are and	class	ificatio	ne in	adiiat	ic ver	ehrate	· C
CO5		light adaptations, a								
005	birds and mammals	-	aaptive i	aarat	1011, a1	100	omote	ny ap	pendag	505 111
Unit-No.	Conte	1	Contact	t	Lea	rning	g Outo	come		KL
			Hour			•	,			
	Basis for Animal King	gdom		U	ndersta	and th	e crite	erion o	on	
	Classification; Phylur	n Porifera:		w	hich aı	nimal	kingd	om is		
	General characters and	classification up		cl	assifie	d, kno	wledg	ge of		
	to classes; Canal System	m in Sycon		Pł	nylum	Porife	era, Cı	nidaria	a,	
	Phylum Cnidaria: Ge	neral characters		Pl	atyhel	minth	es,			
	and classification up to			N	emath	elmin	thes			
I	Polymorphism in Hydr									1,2
_	Phylum Platyhelmint		7							-,-
	characters and classific	•								
	classes; Life history of									
	Phylum Nemathelmin									
	characters and classific	•								
	classes; Life history of <i>lumbricoides</i> .	Ascaris								
	Phylum Annelida: Ge	neral characters		R.	egardii	no dif	ferent			
	and classification up to				naracte	-				
	Metamerism in Annelie				rthrope					
	Phylum Arthropoda:				chinod			,		
	characters and classific									
	classes; Metamorphosi	-								
II	Phylum Mollusca: Ge		_							1,2
	and classification up to		5							,
	in gastropods									
	Phylum Echinoderma	ta: General								
	characters and classific	ation up to								
	classes; Water-vascula	r system in								
	Asteroidea									

	Protochordates: General features		Regarding different	
	Agnatha: General features		characters of Protochordates,	
III	Pisces: General features and	8	Agnatha and Pisces	1,2
	Classification up to class; aquatic	O		
	adaptation of fishes.			
	Amphibia: General features and		Regarding different	
	Classification up to class; Parental care		characters of Amphibia and	
IV	in amphibia		Reptiles.	1,2
11	<b>Reptiles:</b> General features and	5		1,2
	Classification up to Class; Poisonous			
	and non-poisonous snakes.			
	Aves: General features and		Regarding different	
	Classification up to class; Flight		characters of Aves and	
	adaptations in birds		Mammals.	
V	Mammals: General features and	5		1,2
	Classification up to orders; Adaptive	3		
	radiation with reference to locomotory			
	appendages			
Practical	<b>1.</b> Study of invertebrate museum			
	specimen (two specimen from each			
	phylum).			
	<b>2.</b> Study of vertebrate museum			1,2,3,
	specimen (two specimen from each	30		4
	phylum).			
	3. Study of various types of social			
	insects (honeybee/ants) and their			
	nests			

- 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	Cyber			rensi	cs					
Course cod		Total credits: 4		L	T	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 So									
Semester		all/ III Semester of									
Course Objectives	development, n 2. Explore the de from conventio		and ope s types	erating of co	ng sys omput	tems. er cri	mes,	distin	guishi	ng t	them
0.04	4. Learn the prince the seizure, pre 5. Address legal a media, covering and user tracking	paration, and extraction and privacy issues in the topics like file results.	es of contion of it related toration	mput infor to th	ter for mation e collessword	ensics n from ection l cracl	investing investing and king, contact the second se	stigati ected seizu encry	ions, in composite of reption r	nclu uters nags neth	nding s. netic nods,
CO1		fundamentals of with their practical	_		ardwa	ire, a	ccess	ories	and	netv	work
CO2	Describe the various	us cyber and digital	crimes	along	g with	their	practi	cal as	pects.		
CO3	Explain various v aspects.	iruses, adware, mal	lwares a	and t	heir e	ffect	along	with	their	prac	ctical
CO4	Demonstrate the	methods of collecti with their practical			on and	d decr	yptio	n of o	data re	late	ed to
CO5	Demonstrate anal	ysis of media, file	es, fold	er et	c. usi	ng va	arious	com	puter	fore	ensic
	software and hard	ware along with the	ir practi	cal a	spects						
Unit-No.	Conte	nt	Conta Hou		L	earnii	ng Ou	itcom	e	]	KL
I	Fundamentals and Cor Fundamentals of compand accessories- devel disk, physical construct LBA addressing, enco- formats. Memory and Methods of storing dat system. Software. Intro- network, LAN, WAN	outers Hardware opment of hard etion, CHS and ding methods and processor.  Ta. Operating oduction to	8		Funda hardw and no 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	7		Defini crime						1,2

Ш	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	<ol> <li>To identify, seize and preserve digital evidence from crime scenes.</li> <li>To detect deletions, obliterations and modifications of files using cyber forensic software.</li> <li>To identify the IP address of the sender of e-mails.</li> <li>To identify encrypted/hidden files</li> <li>To use digital signatures for securing e-mail and online transactions.</li> <li>To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards cyber forensic software/hardware</li> <li>To carry out imaging of hard disks</li> </ol>	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

C TD'	SEMESTER – III Course Title Basic Instrumental Techniques								
Course Tit						<b>a</b>		0.75	
Course coo	de 23BSFS212R	Total credits: 3	20D L	T	P	S	R	O/F	C
Due ne cuie	ite Nil	Total hours: 30T+3	30P 2	0	2	0 Nil	0	0	3
Pre-requis		Co-requisite Bachelor of Scie	ngo in Fo	roncio	Sciona				
Programm Semester		all/III Semester of Se					Δ		
Course	1	surement principles						σ acci	ıracv
Objectives		ivity, and stability in				cinpin	ASILII.	.g	aracy,
9		idents with chroma		•		instr	umer	ntation,	and
		nphasizing forensic ap							
	_	oscopy principles, el	lectromag	netic sp	pectrur	n, and	sourc	ces, foc	eusing
	on forensic appl			. 1	. 1	1.		c	,•
		edge of light microson and types of microsco						e form	ation,
		al principles of biolog						nasizino	RIA
	and ELISA in fo		,rear and o		iicui uii	ary 515,	Cimpi	iusiziii	5 101/1
CO1		alculation to validate	methods,	ensurii	ng relia	able an	d pre	cise for	rensic
		g with their practical					_		
CO2		aphic methods for qu	_	and qu	antitat	tive an	alysis	s in fo	rensic
	scenarios along wit	th their practical aspec	cts.	-					
CO3	Utilize atomic and	molecular spectrosco	py for for	rensic a	analysi	s and u	ınder	stand e	nergy
	levels in atomic spe	ectra along with their	practical	aspects					
CO4	Develop skills in n	nicroscopic analysis f	for effecti	ve inte	rpretat	ion of	foren	sic evi	dence
	along with their pra	actical aspects.							
CO5	Utilize biochemic	al techniques for a	nalyzing	of bio	ologica	l evid	ence	in for	rensic
	investigations along	g with their practical	aspects.						
Unit-No.	Conte	nt	Contact Hour	L	earnin	g Outo	come		KL
	Basic Concepts of Me	thod Validation	Hour	Demo	nstrate	under	stand	ling	
	Introduction to measure					ion of		-	
	instrumentation, metho	ds of measurement.				oncepts			
	Performance characteri	stics of		meası	ıremen	it, and			
I	Instruments: -accuracy,		7	instru	mentat	ion,			1,2
	sensitivity, linearity, re	-		.1					,
		productomity,		snow	casing	profici	ency	in	
1	repeatability, resolution				_	_	-	in	
	repeatability, resolution stability			assess	_	strume	-	in	
	*			assess	sing ins	strume e	-	in	
	*	n, threshold, drift,		assess perfor charac	sing instance	strume e	nt	in	
	stability	n, threshold, drift,		assess perfor charac	sing instructions in the second sections in the second section sections in the second section section section sections in the section secti	strumer cs.	nt		
	stability  Chromatography- Into	roduction, Review types of		assess perfor charac Apply princi	sing instructions in the second sections in the second section sections in the second section section section sections in the section secti	estruments cs. natogra nd tech	nt		
п	Stability  Chromatography- Intro of basic principles and	roduction, Review types of ayer	5	assess perfor charac Apply princi	sing instructions controlled the con	estruments cs. natogra nd tech	nt aphy nique		1,2
II	Chromatography- Into of basic principles and chromatography, thin la	roduction, Review types of ayer ry and	5	assess perfor character Apply princi- for quant	sing instruction characteristic chromo ples are calitative	estruments cs. natogra nd tech ve and	aphy nique		1,2
II	Chromatography- Into of basic principles and chromatography, thin la chromatography, Theorem	roduction, Review types of ayer ry and ization, Qualitative	5	assess perfor charac Apply princi for qu quant forens	sing instrumence cteristic vehron ples are alitative sic app	estruments cs. natogra nd tech ve and analys	aphy nique is in ns,	es	1,2
II	Chromatography- Intro of basic principles and chromatography, thin la chromatography, Theorem instrumentation, visual control of the chromatography in the chromatography in the chromatography.	roduction, Review types of ayer ry and ization, Qualitative	5	Apply princi for quant forens shows	sing instruments in the content of t	estruments cs. natogra nd tech ve and analys:	aphy nique is in ns, ise in	es	1,2
II	Chromatography- Intro of basic principles and chromatography, thin la chromatography, Theorem instrumentation, visual control of the chromatography in the chromatography in the chromatography.	roduction, Review types of ayer ry and ization, Qualitative asic Application.	5	assess perfor charac Apply princi for qu quant forens showe analy	sing instrumence cteristic chronoples are allitative sic appearing tical m	cs. natogrand tech ve and analys: lication	aphy nique is in ns, ise in	es	1,2
II	Chromatography- Introf basic principles and chromatography, thin la chromatography, Theorinstrumentation, visual and Quantitative, Forer	roduction, Review types of ayer ry and ization, Qualitative asic Application.	5	Apply principal for quant forens show analyst Under	sing instruments in alitative sic appearing tical merstand	cs. natogrand tech ve and analys: lication experti	aphy nique is in ns, ise in nciple	es	1,2
II	Chromatography- Into of basic principles and chromatography, thin la chromatography, Theoremstrumentation, visual and Quantitative, Forer Atomic & Molecular &	roduction, Review types of ayer ry and ization, Qualitative asic Application.  Spectroscopy: - agenetic spectrum,	5	Apply princifor quant forens show analy Under	sing instrumence eteristic chronoples are allitative sic appearing etical merstand mic and instrument of the control of the co	cs. natogrand tech ve and analys: lication experti ethods	aphy nique is in ns, ise in . nciple	es	1,2
II	Chromatography- Introf basic principles and chromatography, thin la chromatography, Theorinstrumentation, visual and Quantitative, Forer Atomic & Molecular & Spectroscopy, electrom	roduction, Review types of ayer ry and ization, Qualitative asic Application.  Spectroscopy: - agnetic spectrum, eir utility and	5	Apply principal for quant forens show analyst Under of ato spectra	sing instrumence cteristic chronoples are alitative sic apprecial merital mic and coscopy	cs. natogrand tech ve and analys: lication experti ethods the prind	aphy nique is in ns, ise in nciple	es es the	1,2
	Chromatography- Introf basic principles and chromatography, thin land chromatography, Theorem instrumentation, visual and Quantitative, Forem Atomic & Molecular & Spectroscopy, electrom sources of radiation, the	roduction, Review types of ayer ry and ization, Qualitative asic Application.  Spectroscopy: - agnetic spectrum, eir utility and al sources for UV,		Apply princi for qu quant forens show analyte Under of ato spectre electre.	sing instrumence cteristic chronoples are alitative sic appeasing tical merstand mic and coscopy comagni	cs. natogrand tech ve and analys: lication experti ethods the print d mole y, inclu	aphy nique is in ns, ise in nciple ecular iding	the m,	
	Chromatography- Introf basic principles and chromatography, thin la chromatography, Theorinstrumentation, visual and Quantitative, Forer Atomic & Molecular & Spectroscopy, electrom sources of radiation, the limitations, convention	roduction, Review types of ayer ry and ization, Qualitative asic Application.  Spectroscopy: - agnetic spectrum, eir utility and al sources for UV, s, sources for		Apply principal for quant forens show analytic of ato spectra electroradiate and the control of	sing instrumence cteristic chronoples are allitative itative casing cical more are allitative communication sociopy communication so	cs. natogrand tech ve and analys: lication experti ethods the prin d mole y, inclu etic spe	aphy nique is in ns, ise in ciple ecular iding ectrui	es the m, neir	
	Chromatography- Intro of basic principles and chromatography, thin la chromatography, Theorinstrumentation, visual and Quantitative, Forer  Atomic & Molecular & Spectroscopy, electrom sources of radiation, the limitations, convention visible and infrared ray	roduction, Review types of ayer ry and ization, Qualitative asic Application.  Spectroscopy: - agnetic spectrum, eir utility and al sources for UV, s, sources for		Apply principal for quant forens show analytic of ato spectra electroradiate and the control of	sing instrumence cteristic chronoples are allitative itative casing cical more are allitative communication sociopy communication so	cs. natogrand tech we and analys: lication experti ethods the print d mole y, inclu etic spe urces, a	aphy nique is in ns, ise in ciple ecular iding ectrui	es the m, neir	

IV	Microscopy- Light Microscopy- 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	5	Analyze and interpret microscopy principles, including geometrical optics, image formation, and magnification, applying these concepts to forensic investigations.	1,2
V	Biochemical techniques: -Biological and biochemical techniques: general principles of biological/ bio-chemical analysis, Radio Immune Assay (RIA), ELISA.	5	Apply biochemical techniques, demonstrating knowledge of general principles and practical application, showcasing proficiency in methods like Radio Immune Assay (RIA) and ELISA in forensic	1,2
Practical	<ol> <li>To prepare sample (various conc., M, %) etc.</li> <li>To understand validation of instrumental methods</li> <li>TO analyze samples using TLC.</li> <li>To analyse sample using UV spectrophotometer</li> <li>To analyse sample using compound microscope</li> <li>To analyse sample using comparison microscope</li> <li>To analyse sample using biochemical techniques</li> </ol>	30		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

SEMESTER – III										
Course Tit	tle	Questioned		ent Ex	xamina	ation				
Course coo		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-requisit					Nil			
Programm	•	Bachelor of So								
Semester	•	all/III Semester of							c	
Course	1. Understand the	•						oes, i	torgery	, and
Objectives		collecting standards						siolos	ov cla	ss and
		2. Explore the principles of handwriting identification, covering physiology, class and individual characteristics, natural variations, and examination of tampered								
	documents.	,		,						1
	3. Examine disput	ed documents, suc	h as wil	lls, de	eds, cl	neque	s, and	vari	ous ty	pes of
		g ATM and credit of								
	4. Learn about th			•		•			ter, bu	ıılt-up
	5. Familiarize wit	the identification o							a doc	umant
		arious light sourc								
		Video Spectral Con	_	-	-	,	о орг		100	1011010
CO1	Identify characteris					ires fo	or doc	umei	nt com	parison
	along with their pra	ctical aspects								
CO2	Understand individ	ual handwriting ch	naracteri	stics	and an	alyze	ink, p	aper	, photo	copies,
	and other document	t elements along wi	th their	practi	cal asp	ects.				
CO3	Examine diverse di	sputed documents	frequent	ly en	counter	ed in	foren	sic so	enario	s along
	with their practical	aspects.								
CO4	Analyze security do	ocuments, employir	ng variou	us tec	hnique	s to de	termi	ne au	thentic	city and
	detect forgeries alor	ng with their practi	cal aspec	cts.						
CO5	Apply method solv	ing practical skills	in utiliz	ing a	dvance	d inst	rumer	ıtatio	n for a	ccurate
	and detailed examin	nation of questioned	d docum	ents a	long w	ith th	eir pra	actica	ıl aspec	ets.
Unit-No.	Conter	nt	Cont		L	earniı	ng Ou	tcon	ıe	KL
	Tutus dusation to sussatio		Hou	ır	Interes	14:		1		
	Introduction to questio				Introd			Įa-		
	types, Forgery and its ty	_			defini			inoti	on	
	characteristic features of	-			prelin	-				
-	handwriting/signatures,				and b		oois re	garu	ing	1.0
I	components of forged of		8		the fi	eia.				1,2
	their examination, proc									
	collection of standards	for comparison of								
	documents, admitted/	matrima/rimitima								
	genuine/documents/sign	· · · · · · · · · · · · · · · · · · ·			Instru			:		
	Principle of Handwritin introduction of handwriting	-								
					quest			nems	•	
	handwriting characteristic individual characteristic				exam	mano	11.			
	variations in handwritir	•								
	variations, disguised w	-								
II	_	-	7							1,2
	examination, tampered		,							
	addition, alteration, era interlineation, page sub									
	writing. examination of									
	~									
	for the ink, paper, photo	-								
	printouts and scanned d	ocuments.								<u> </u>

III	Disputed documents - wills, deeds, 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.	10	Comparison of documents by the age of ink, variations, divergences and characteristic of handwriting.	1,2
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.	1, 3
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	1, 3, 8

SEMESTER – III												
<b>Course Tit</b>	tle	Forensic Ballistics										
Course code		23BSFS214R	Total credits: 4		L	T	P	S	R	O/F		C
			Total hours: 45T+30		3	0	2	0	0	0		4
Pre-requisite		Nil	Co-requisite					Nil				
Programme		Bachelor of Science in Forensic Science										
Semester		Fall/III Semester of Second year of the programme										
Course		1. Understand the definition, scope, and significance of forensic ballistics, including the										
Objectives		history and development of gunpowder and firearms.										
		2. Explore improvised and country-made firearms, gunshot residues, and methods of										
		analyzing residues on shooting hands and targets.										
		3. Classify small firearms and ammunition, examining firing mechanisms, types of										
		ammunition, and marks produced during the firing process.  4. Delve into internal ballistics, covering propellant ignition, shape and size of										
		propellants, and factors influencing internal ballistics.										
		5. Study external ballistics, including vacuum trajectory, air resistance effects,										
		projectile stability, and trajectory computation, as well as terminal ballistics, focusing										
		on the impact of projectiles on targets, ricochet effects, and firearms injuries.										
CO1		Understand the history and development of Gun powder firearms, IED, GSR and need										
		and scope of forensic ballistics along with their practical aspects.										
CO2		Explain types of Firearm and ammunition and its composition along with their practical										
		aspects										
CO3		Explain the type and mechanism of series of events that takes place after firing inside the										
		firearm along with their practical aspects.										
CO4		Explain the series of events takes place after the bullet will leave the muzzle of the										
CO5		firearm and factor affecting its velocity along with their practical aspects.										
		Examine the effect of bullets after terminating and different factors resulting it along with their practical aspects.										
Unit-No. Co		ntent	Contact		Lagi	nina	Outo	rome		KL		
Cint-140.	Cu	ntent		Hour		Lai	mng	Out	Joine		17	.11
	De	finition, Scope, an	d Significance of		Introduction to ballistic-							
	Fo	rensic Ballistics; C		need & scope. History and								
		finition, History a	development of gun									
I An		earms – Definition	powder, firearms, ied, gsr-									
		ms Act. History ar	_	its collection and					sis. 1,2			
		provised & countr	8								,	
		rmation of gunsho										
		alysis of gunshot re										
		thing.	th special reference to									
			eir operation. Firing		Cla	essific	ration	of fi	rearm	1 28		
		chanisms of differ	_			their						
		pes of ammunitior		_			Differ	ent				
		tures and characte					ts and					
TT		es of cartridges ar		firearms.					1	1.2		
II		priming compounds. Projectiles. Different									1,	,2
	typ	es of marks produ										
	pro	cess on cartridge										
	bre	ech face marks, cl	namber marks,									
	ext	ractor and ejector	marks									

III	Internal Ballistics- Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics	10	Detailed study of internal ballistics- series of events 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	<ol> <li>To identify different parts of firearms</li> <li>To identify different parts of firearm ammunition</li> <li>To perform collection of GSR particles.</li> <li>To perform chemical analysis for presence of GSR.</li> </ol>	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		

	SEMESTER – III												
Cours	se Title		•	Professiona									
Cours	se code	23BSFS215R	Total credits: 1		T	P	S	R	O/F	C			
<b>T</b>		2747	Total hours: 30	OP 0	0	2	0	0	0	1			
	equisite	Nil	Co-requisite	7		<u> </u>	Nil						
	amme	<b>1</b> 17	Bachelor of S										
Semes			all/III Semester o						11 : -	- 1			
Cours Objec		1. Introduce the fur	ndamental conce _l specific crimes.	ots of forens	ic psycl	nology	and th	ie psyc	nologic	aı			
Onjec	.u v C3	2. Explore the rela	*	criminality	and mei	ntal illı	nesses	such a	s necro	nhilia			
			iia, supported by			iitai iii	1103303	sucii a	is neero	piiiiu			
		3. Provide knowled				lures, a	and sco	pe of	narco-				
			ng detailed case s			,		1					
		4. Educate students	s on the principle	s, instrumen					pe of B	EOS,			
			brain mapping, su										
		5. Discuss the acce	eptance and applic	cation of psy	cholog	ical stu	ıdy evi	dence	in judic	cial			
•	01	systems.	io concents of fam	oncio povole	1000 00	od tha	novich -	logica	1 footo:				
	01	Understand the basic contributing to spec		ensic psycho	лоgy ai	ia the	psycno	nogica	u ractor	S			
C	O2	Analyze the relation		minality and	mental	l illnes	ses an	d annl	v this				
	<i></i>	knowledge to case s		iiiiiaiity ailt	. moma		oco, al	ա սբբո	y uns				
C	O3			ding its hist	ory, pri	nciples	s, proce	edures	, and				
			Conduct narco-analysis by understanding its history, principles, procedures, and pplications in forensic investigations.										
C	O4	Utilize BEOS, poly	Jtilize BEOS, polygraph, and brain mapping techniques, understanding their principles,										
		procedures, and sco											
C	<b>O5</b>	Evaluate the judicia	al acceptance and	application	of psyc	hologi	cal evi	dence	in court	t			
Unit-		proceedings.  Content		G , ,									
Omt-	ī			Contoot		Learni	no O	itcome	4	KI			
No.		Content		Contact Hour		Learni	ing Ou	tcome	<b>;</b>	KL			
	Introdu	action: Introduction t	to forensic			Learni in fund				KL			
No.				Hour	Expla		damen	tal con					
		ection: Introduction t logy, Psychological			Expla	in fund	damen	tal con		<b>KL</b> 1,2			
No.	Psycho specific	action: Introduction t logy, Psychological c crime	explanations of	Hour	Expla of for	in fundensic p	damen	tal con logy.	ncepts				
No.	Psycho specific The rel	action: Introduction to logy, Psychological corime	explanations of lity to mental	Hour	Expla of for The p	in fundensic posychol	damen	tal con logy.	ncepts				
No. I	Psycho specific The rel illness:	lection: Introduction to logy, Psychological ecrime ationship of crimina Necrophilia, Schizo	explanations of lity to mental	Hour 6	Expla of for The p	in fundensic p	damen	tal con logy.	ncepts	1,2			
No.	Psycho specific The relillness:	action: Introduction to logy, Psychological corime ationship of crimina Necrophilia, Schizopypes, case	explanations of lity to mental	Hour	Expla of for The p	in fundensic posychol	damen	tal con logy.	ncepts				
No.	Psycho specific The rel illness: their ty studies	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case	lity to mental phrenia and	Hour 6	Expla of for The p	in fundensic posychol	damen osycho logical ific cri	tal con logy. factor mes.	ncepts	1,2			
No. I	Psycho specific The rel illness: their ty studies	action: Introduction to logy, Psychological corime ationship of crimina Necrophilia, Schizopypes, case	lity to mental phrenia and	Hour 6	Expla of for The p	in fundensic posychol	damen osycho logical ific cri	tal con logy. factor mes.	ncepts	1,2			
I II	Psycho specific The rel illness: their ty studies Narco-	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case	lity to mental phrenia and	6 6	Expla of for The p behind	ensic posychold speci	damen osycho logical ific cri	tal con logy. factor mes.	ncepts	1,2			
No.	Psycho specific The rel illness: their ty studies Narco-	action: Introduction to logy, Psychological ecrime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. De	lity to mental phrenia and	Hour 6	Expla of for The p behind Performed under	ensic posychold speci	damentosycho logical ific cri co-ana	factor mes.	rs	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced	action: Introduction to logy, Psychological ecrime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. De	lity to mental phrenia and	6 6	Expla of for The p behind Performed under applications and the control of the con	in fundensic possible properties of the control of	damen osycho logical ific cri	factor mes.	rs	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies	action: Introduction to logy, Psychological ecrime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. De	lity to mental phrenia and Principle, etailed Case	6 6	Expla of for The p behind Performed applications of the control of	ensic posychold special rm narestandinations	damentosycho logical ific cri co-ana ng its p in for	factor mes.	es	1,2			
I II	Psychospecifical The relillness: their tystudies Narco-Proced studies BEOS,	action: Introduction to logy, Psychological corime  ationship of crimina Necrophilia, Schizopypes, case  Analysis: History, Fure and its Scope. Do	lity to mental phrenia and Principle, etailed Case apping: History,	6 6	Explain of for The pubehind Performance applications and Utiliz	ensic posycholod special rm narestanding cations tigation	damen osycho logical ific cri co-ana ng its p in forns.	factor mes. lysis, princip rensic	elesand	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies BEOS, Princip	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. Doc.  Polygraph, Brain male, Instrumentation, In	lity to mental phrenia and  Principle, etailed Case  apping: History, Procedure and its	6 6	Expla of for The p behind Performed application application of the transfer of	ensic personal dispersion of the special control of the special cont	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl	factor mes.	es in	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies BEOS, Princip	action: Introduction to logy, Psychological corime  ationship of crimina Necrophilia, Schizopypes, case  Analysis: History, Fure and its Scope. Do	lity to mental phrenia and  Principle, etailed Case  apping: History, Procedure and its	6 6	Expla of for The p behind Performent under application application of the control	ensic possible sychological special standing ations tigation mapping is considered to the constitution of	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl itexts,	factor factor mes. lysis, orincip rensic ygraph hnique suppor	elesand	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies BEOS, Princip	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. Doc.  Polygraph, Brain male, Instrumentation, In	lity to mental phrenia and  Principle, etailed Case  apping: History, Procedure and its	6 6	Expla of for The p behind Performance under application forens under the control of the control	ensic posycholod special rm narestanding ations tigation mapping is constanding standing standing at the second standing	damen osycho osy	factor mes. lysis, orincip rensic ygraph nnique suppor	elesand  n, and es in eted by	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies BEOS, Princip Scope.	ction: Introduction to logy, Psychological ecrime ationship of crimina Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. Doc.  Polygraph, Brain male, Instrumentation, I Detailed Case studies	lity to mental phrenia and  Principle, etailed Case  apping: History, Procedure and its es	6 6	Expla of for The p behind Performance invest Utiliz brain forens under princi	ensic possible dispersion narrastandin eations tigation mappi sic constandin estandin estandi	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl atexts, s ng thei and proces	tal con logy. factor mes. lysis, orincip rensic ygraph hnique suppor r	elesand  n, and es in eted by	1,2			
I II	Psycho specific The rel illness: their ty studies Narco- Proced studies BEOS, Princip Scope.	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. Document of the property of t	lity to mental phrenia and  Principle, etailed Case apping: History, Procedure and its es	6 6	Expla of for The p behind Performance under application forens under princite Evaluation of the princi	ensic possession of the sychological and a special and a s	damen osycho logical ific cri co-ana ng its p in forms.  OS, polyng teclutexts, song their nd process accept	factor mes. lysis, orincip rensic ygraph mique suppor	alesand  n, and es in eted by s anduse	1,2			
I II III	Psychospecific The relillness: their tystudies Narco-Proced studies BEOS, Princip Scope. Aspect accepta	ction: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. December 1.  Polygraph, Brain male, Instrumentation, Instrumentation, Instrumentation, Inception of Psychology in pudicial system:	lity to mental phrenia and  Principle, etailed Case apping: History, Procedure and its es	6 6 6	Expla of for The p behind Performance application for the principle of psylin Evaluation of psylin Evaluation for the principle of psylin for the principle of the pri	ensic personal sychological special standing attempts and attempts	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl itexts, s ng thei nd proces	tal con logy.  factor mes.  lysis, princip rensic  ygraph anique suppor recedures tance avidence widence	elesand on, and os in orted by sanduse sein	1,2 1,2 1,2			
I II	Psychospecific The relillness: their tystudies Narco-Proced studies BEOS, Princip Scope. Aspect accepta	action: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. Document of the property of t	lity to mental phrenia and  Principle, etailed Case apping: History, Procedure and its es	6 6	Expla of for The p behind Performance invest Utiliz brain forens under princi Evalu of psy judici	ensic personal sychological systematics are the cychological systematics and in the cychological systematics are the cychological sy	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl itexts, s ng thei nd proce accep gical e ems, u	factor factor mes.  lysis, orincip rensic suppor redures tance avidence ndersta	alesand  n, and es in eted by s anduse	1,2			
I II III	Psychospecific The relillness: their tystudies Narco-Proced studies BEOS, Princip Scope. Aspect accepta	ction: Introduction to logy, Psychological corime ationship of criminal Necrophilia, Schizopypes, case:  Analysis: History, Fure and its Scope. December 1.  Polygraph, Brain male, Instrumentation, Instrumentation, Instrumentation, Inception of Psychology in pudicial system:	lity to mental phrenia and  Principle, etailed Case apping: History, Procedure and its es	6 6 6	Expla of for The p behind Performance application for the principle of psy judicii its im	ensic personal sychological special standing attempts and attempts	damentosycho logical ific cri co-ana ng its p in for ns. OS, poly ng tecl texts, s ng thei nd proce e accep gical e ems, u n cour	factor factor mes.  lysis, orincip rensic suppor redures tance avidence ndersta	elesand on, and os in orted by sanduse sein	1,2 1,2 1,2			

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Understand the basic concepts of forensic psychology and the	1, 3						
	psychological factors contributing to specific crimes.	1,0						
2	Analyze the relationship between criminality and mental	1, 3						
	illnesses, and apply this knowledge to case studies.	1, 3						
3	Conduct narco-analysis by understanding its history, principles,	1,3						
3	procedures, and applications in forensic investigations.	1,5						
	Utilize BEOS, polygraph, and brain mapping techniques,							
4	understanding their principles, procedures, and scope in forensic	1, 8						
	contexts.							
5	Evaluate the judicial acceptance and application of psychological	1, 5						
3	evidence in court proceedings.	1, 5						

SEMESTER – III											
Course Ti	itle		English I	<b>_anguag</b>	e for	· excel	lence	_			
Course co	de	23UBPD212R	Total credits: 2	<u> </u>	L	T	P	S	R	O/F	C
			Total hours: 60	)P	0	0	4	0	0	0	2
Pre-requis		Nil	Co-requisite					Nil			
Programn	ne		Bachelor of S								
Semester			Fall/III Semester		-						
Course		. To enable stude		erstand a	nd p	ractice	trans	forma	tion of	f sentend	ces,
Objectives		uses of correct preposition.									
		<ul><li>2. To augment the writing skills in different areas including CV and cover letter writing.</li><li>3. To boost productivity and performance at work, which assists in the</li></ul>									
	-		professional goals		at v	vork, v	wnicn	assisi	is in t	ne	
		I. To evaluate the			ndida	ate					
CO1		Enable students to					ample	v and	comp	ound	
		entences, and disti						A, and	comp	ound	
CO2		Teach students the						, write	parag	raphs ar	nd
		etters, and prepare							1 0	•	
CO3		Help students cond	uct SWOT analys	ses, pract	tice s	self-reg	gulatio	on, and	d main	tain per	sonal
004		nygiene.	1 1 1 1				•			C1 1	
CO4		Equip students with knowledge about non-verbal communication, types of body anguage, and their impact.									
CO5		Train students in pl		ıcting gr	nın	discus	sions	effect	ively (	disagree	ino
		and summarizing to			oup	aiscus	510115,	CIICCI	ivery	ansagree	g,
Unit-		Content	J	Contac	et	I	Learn	ing O	utcom	e	KL
No.				Hour							
		r: Use of preposition	•			Descri	be pre	epositi	on, sin	, simple	
I qu	uestion	s, simple, complex	3		and complex sentences				1,2		
se	entence	s.									
G1	ramma	r: Active and p	assive voice,	2					voice	es and	1 2
II din	rect an	d indirect speech.		3		type o	f spee	ch			1, 2
Se	elf-Mai	nagement Skills: S	WOT analysis,	_		Explai	n self	-regula	ation a	nd	1, 2,
1111		lation, personal hy	· · · · · · · · · · · · · · · · · · ·	3		person		_			3
		rbal Communication	<u>-</u>								
		nguage: What is N				Explain nonverbal communication, body language					
	•	nication & Body L				•	amou	ion, o	ouj iu	guuge	
		s of Communication	0 0								1, 2,
		nguage, Importanc		3							
	-	nguage, Important nguage, Types of (	-								3,
	•										
	_	Body Language, Bo									
-		l Don'ts, Doubt C									
	_	iscussion (Theory)	-			Develo	•	owledg	ge on g	group	
V/	_	, elements ad skill		3		discus	sion.				1,2,
ef		disagreeing, sumi	marizing and								1,4,
1	taining	the objective.									1

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						

Course Titl	Rad						SEMESTER – III										
	E Das	sic Financial	Literacy														
Course code	e 23UUFL211R Total	credits: 1	L	T	P	SR	O/F	C									
	Total	hours:30P	0	0	2	0 0	0	1									
Pre-requisi	te Nil Co	-requisite		1		Nil	I										
Programme	Bachelor of	Bachelor of Science in Forensic Science															
Semester	Fall/ 3rd semest	er of second	year of the	prog	ran	1											
Course		1. To create awareness among students about the need for possessing financial literacy															
Objectives	education.																
	2. Identification of money as a work	2. Identification of money as a working asset.															
	3. Impart the ability to make better	financial dec	isions														
CO1	The students would be able to u	nderstand th	e importan	ce of	fin	ancial	Knov	wledge									
	and prepare financial plans and bud	gets and plan	and manage	e pers	onal	finan	ces.										
CO2	The students would be able to under	erstand the ne	ed and vari	ous ki	ind	of bar	king										
	institutions' instrument and their uti																
CO3	The student would be able to descri	be the import	ance of inst	urance	e sei	vices	as soc	ial									
	security measures.																
CO4	The student would be able to manage	•															
CO5		Students will learn how to assess and compare different investment options to															
TT '4 NT	make informed financial decisions.	0 4 4	T .	0.4				TZT									
Unit-No.	Content	Contact Hour	Learning	Outc	ome	<b>;</b>		KL									
	Introduction:	Define financial literacy and															
			its import			•											
	• Meaning, need and importance of		finance m		_		1										
	Financial Literacy; • Different components of Financial		Identify c	_			1 96										
	Literacy;		savings, in														
	Prerequisites of financial literacy;		institution														
	• Savings– Meaning and Difference	6	avenues.	.,			-	1,2									
	between savings and investment;							1,2									
	• Types of Financial Institutions and																
	the services provided- Banking and																
	Non-Banking;																
	• Different investment avenues.																
	Financial Planning		Explain th	ne sign	nific	ance	of										
	• Meaning, need and importance for		financial p	olanni	ng i	n											
	financial planning,		achieving	finan	cial	goals	and										
,	Budgeting and its importance in		understan	d bud	geti	ng as	a										
	financial planning;		tool for m	anagi	ng i	ncome	and										
	<ul> <li>Steps to involved in Financial</li> </ul>		expenses														
II	Planning Process;	6						1,2,3									
1	Preparation of personal budgets,																
	budget surplus and budget deficit,																
	avenues for savings from surplus,																
	sources for meeting deficit.																
	Informal Society funds and crowd																
l l	funding	l	I														

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	<ul> <li>Insurance-As financial service provider:</li> <li>Different types of Risks and their Management, Diversification of risk;</li> <li>Meaning, need and importance of Insurance</li> <li>Pension and retirement policies;</li> <li>Post office life insurance schemes, Postal life insurance and rural postal life insurance.</li> </ul>	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	asic lifesav	ing s	skills							
Course	code	23UULS212R	Total credits		L	T	P	S	R	O/F		C	
			Total hours:		1	0	0	0	0	0		1	
Pre-requ		Nil	Co-requi						Vil				
Progran		Bachelor of Science in Forensic Science											
Semeste	r	Fall/ 3rd semester of second year of the program											
Course		1. To learn and demonstrate essential Basic Life Support (BLS) techniques for assisting											
Objectiv	ves	in medical emerg	_	•	_								
		2. To enhance comr			l con	flict re	solut	ion sk	alls to	impro	ve		
		personal and prof											
		3. To Understand the Triage system, recognize different levels of triage, and classify common medical emergencies to prioritize patient care effectively.											
	_				_				*				
CO	1	Demonstrate knowle	-	o perform	CPR	use an	ı AE	O, an	d resp	ond to	cho	king	
~~		in adults and children			-			•					
CO2		Understand the signif									<b>5.</b>		
CO	5	Apply knowledge and	a skill about pr	e-hospital c	are a	ınd ma	nagei	nent (	ot trau	ıma			
GO		emergencies.		6.1 70				1.1					
CO ₂		•	Understand the principles and purpose of the Triage system in healthcare settings.										
COS	•	Identify and manage	common medic								1		
Unit-No.		Content		Contact		Le	earni	ng Oı	ıtcom	ie	K	<b>CL</b>	
				Hour									
		c Life Support (BLS							ic life				
		roduction of BLS								ain of			
_		ain of survival						terent	asses	ssment			
I		BCs Assessment		3	t	echnic	lues.				1	1,2	
		R and Ventilation											
		chnique	t and abilduan										
		ED - Choking for adult	and children		1	[11,10+m0	ton di	ffamar	.+				
		skills roduction				Illustra							
		mmunications Skills				commu situatio							
II		uational Skills		3		includi					1,	2,3	
		am Work			1	iliciudi	ng te	amwc	ЛK.				
		her Soft Skills											
		ıma emergencies			1	Explai	ns	about	di	fferent			
		troduction				rauma		nerge		and			
		riorities of Initial appr	oach in pre-					_		rauma			
		ospital care	ouen in pro			emerge			BB .				
		cene safety						•					
		rimary assessment											
***		leeding control		2							1	2.2	
III		elmet removal		3							1,	,2,3	
		are of amputated body	part										
	h)Ex	strication of victims a	nd safe										
		ansfer											
	i) C	ervical spine stabiliza	tion										
		ervical collar applicati											
	k) - S	Splinting of broken Li	imbs										

IV	<ul> <li>Triage system</li> <li>Introduction</li> <li>Flow chart approach of Triage</li> <li>Triage of Multiple Casualties in Pre-Hospital setting</li> <li>Triage of Single casualty</li> </ul>	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,	4, 5,7,8,9						
1	and respond to choking in adults and children.	4, 3,7,0,9						
2	Understand the significance of communication and teamwork in	4 5 7 8 0						
<u> </u>	various situations.	4, 5,7,8,9						
3	Apply knowledge and skill about pre-hospital care and	4, 5,7,8,9						
3	management of trauma emergencies.	4, 3,7,6,3						
4	Understand the principles and purpose of the Triage system in	4, 5,7,8,9						
4	healthcare settings.	4, 3,7,0,9						
5	Identify and manage common medical emergency conditions.	4, 5,7,8,9						

	SEMESTER – III											
Course Ti	tle		C	hemistr	y- 3							
Course co	de	23FSCH216R	Total credits: 3		L	T	P	S	R	O/F	C	
			Total hours: 30T -		2	0	2	0	0	0	3	
Pre-requis	site	Nil	Co-requisite	•				Nil				
Programn	ne	Bachelor of Science in Forensic Science										
Semester			Fall/ 3rd semester of	of secon	d yea	r of th	e pro	gram				
Course		1. Demonstrate a comprehensive knowledge of the formation, reactions, and										
Objectives	S	rearrangement mechanisms of alcohols, phenols, ethers, and epoxides										
			iency in Werner's			•						
			field theory, and ma	_						_		
		* * *	dynamic principles,		_					work,	and	
		*	e gas expansion scen			_						
			ne fundamental pri	_				-				
			techniques, includir	_			frared	, Ato	mic A	Absorp	tion,	
			ion, Mass, and X-ray	•	•							
		_	ency in chemical ki			-				ınfluen	cing	
			order, molecularity,							1 .1	1	
CO1			gain knowledge abo	-			_	_				
			en containing organ their named reaction	_	ouna	s such	as ai	COHOIS	s, phe	nois, ei	ners	
CO2		-			of co	ordin	ation	comp	ounde			
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										
003		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										
CO5		that the rate of cl	nange and how it ca	n be me	asure	d. Det	termir	e rate	law o	of chen	nical	
		change based on	experimental data									
Unit-		Conte	nt	Contac	et	Lea	rning	g Outo	come	]	KL	
No.				Hour								
	Oxyg	gen containing orga	anic compounds		Α	nalyz	e prop	erties	and			
		ohols, Phenols, Eth	_		re	eactior	ns of a	lcoho	ls,			
	Meth	nods of formation a	nd chemical		p	henols	s, ethe	rs, and	1			
		ions of Monohydri			e	poxide	es.					
	_	dric Alcohols (vici										
		ative cleavage with										
		4] and Pinacol-Pina										
I		angement. method									1,2	
_		nical reactions of g	*	10							-,-	
	_	aration of Phenols,										
		erties and acidic ch										
and j		parative acidic strengths of alcohols										
		ohenols, resonanac										
	_	oxide ion. Reaction	_									
		rophilic aromatic s										
	acyla	tion and carboxyla	tion Mechanisms									

	of Fries rearrangement. Gatterman synthesis, Hauben. Heesch reaction. Lederer-Mianasse 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.			
п	Coordination compounds- Werner's coordination theory, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.	8	Understand coordination 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. Orgelenergy 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	7	Study reaction rates, orders, and mechanisms.	1,2
Practical	reaction.  1. Preparation and Properties of Organic Compounds  2. Analysis of Coordination Compounds.  3. Magnetic and Spectral Properties of Metal Complexes.  4. Determination of heat capacity and Joule-Thomson coefficient.  5. 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	II							
Course	Title		Phys	ics- 3							
Course	code	23FSPH217R	Total credits: 3		L	T	P	S	R	O/F	C
			Total hours: 30T + 30I	•	2	0	2	0	0	0	3
Pre-req	uisite	Nil	Co-requisite					Nil			
Program	nme		Bachelor of Science								
Semeste	er		Fall/ 3rd semester of sec	ond yea	ar of	the p	progr	am			
Course			ave motion concepts inclu	ding wa	ave ty	ypes,	veloc	ities,	and i	ntensit	y
Objectiv	ve	based on inver	•		_						
		_	ectromagnetic nature of li	ght and	appl	y prir	nciple	s like	Huy	gens ai	nd
		Fermat's to wa		1	. ,			. 1	1.	NT 4	
		-	erence, diffraction, and po	olarızatı	on p	henor	nena,	ınclu	ding	Newto	on's
		rings and Brev 4. Utilize matrix	vster's law. algebra to solve physics p	rohlam	c inv	olvin	a Har	mitia	n uni	tory o	nd
		orthogonal ma		nooiem	.S 111 V	OIVIII	g Hei	шиа	ıı, uııı	itary, a	uiu
		_	ntial equations and field	concen	ts to	mod	el nh	vsical	syst	ems i	ısino
			nctions and error analysis.	_	ts to	mou	or pii	ysicai	byst	C1115, C	<i>a</i> 51115
CO	1		ncept of waves, electroma		natur	e of 1	ight.				
CO			pt of vibration like free, d					s etc			
CO	3		een wave optics and ray of								
CO	4	Discuss the conce	pt of interference, diffract	ion, pol	larisa	tion					
CO	5	Illustration of mat	rices and their properties,	differe	ntial	equat	ions a	and th	eir m	ethods	of
		solutions									
Unit-		Con	tent	Conta		Le	arnin	ıg Ou	tcom	e	KL
No.				Hou	r						
			vave motion: plane and				-	nd ana	alyze		
	_		linal and transverse			wave	e type	s.			
			(travelling) waves,								
			equation, particle and wave velocities, ty of wave, inverse square law.								
I		•	f light, definition and	6							1,2
		_	Huygens principle,								
		oral and spatial cohe									
		*	on in establishing laws								
	_	lection and refraction	_								
			ndition of sustained			Expl	ain li	ght's '	wave		
			treatment, theory of			_	erties	-			
	Newt	on's rings, determin	nation of wavelength and								
II	refrac	tive index using Ne	wton ring apparatus.	6							1.2
11	Diffra	action of light: Fresi	nel and Fraunhofer class	0							1,2
	of dif	fraction, diffraction									
		_	ofer diffraction at single								
		lane diffraction gra									
		zation of light and					-	rferen			
	_	-	n of polarization of light	_		dittra	action	, pola	ırızati	ion	1.2
III	-		and scattering. Huygen's	8							1,2
	_	-	Brewster's law, double								
	refrac	uon.									

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

•	CO PO Mapping	
SN	Course Outcome (CO)	Mapped ProgramOutcome
1	Understand the concept of waves, electromagnetic nature of light.	1
2	Discuss the concept of vibration like free, damped, force 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 equations and their methods of solutions.	1

		SEMESTER –	III							
Course Tit	tle		logy- 3							
Course co		Total credits: 3		ТР	S	R	O/F	С		
		Total hours: 30T + 30P	2	0 2	0	0	0	3		
Pre-requis	ite Nil	Co-requisite			Nil	<u> </u>	l	<u> </u>		
Programm		Bachelor of Scienc	e in Fore	nsic Scien	ce					
Semester		Fall/ 3rd semester of se	second year of the program							
Course	1. This course a	nims to educate student on c	concepts o	f forestry						
Objectives		edge of forest dendrology, f								
		3. The course further deals with physiology of forest, forest management and forest								
CO1	pathology	story and basic concept of F	Corostry							
CO2		endrology and knowledge o		ract						
CO2	•	f forest types and forest mar		1681						
CO3		ysiology in forestry	nagement							
CO5		ne forest pathology, causes of	of forest d	iceacec						
Unit-No.	_	Content	Contact	1	ning O	utoom	<u> </u>	KL		
UIIII-NO.	•	Ontent	Hour	Lean	inig O	utcom	.6	KL		
	Introduction Fores	try: History of forestry,	Hour	History	types	and				
		orest, Basic concepts on		policies						
		idia. Important acts and		poneres	01 101	ost.				
I	policies related to I	-	6					1,2		
_	_	Forest management: Definition and scope of orest management, principle of forest						-,-		
	_									
	management and th									
	-	duction, importance and		Importa	ince, so	cope ar	nd			
	scope of dendrole	ogy. Role of vegetative		morpho		_				
***		tification of woody forest		forest a	nd Eco	tourisr	n.	1.0		
II	flora	nition and elements of	6					1,2		
		ples and objectives of								
		al of ecotourism in India.								
	Plant Physiology:	Introduction to tree		Importa	nce of	tree				
	physiology, Photos	ynthesis. Water relation of		physiol	ogy in	relatio	n			
III	forest trees, tra	nspiration from forest	8	to fores	try			1,2		
	_	nental effects on growth	· ·							
	and development.									
		Diversity: Forest types of		Importa						
		ystem-abiotic and biotic		ecosyst	em, bi	iotic a	and			
IV	_	heir interaction, Nutrient	_	abiotic		1.0		1,2		
	-	anagement. Conservation	5	Compo			est	ŕ		
		versity, diversity hot spots,		manage		nd				
	Principle of conserv			ecotour						
		Importance of forest		Princip						
		les of forest pathology,		patholo						
V		iseases-Physiological and al symptoms of forest tree	5	forest diseases and plant quarantine.						
		of forest diseases, plant	3	prant qt	ıaı allıll	ic.				
	quarantine	1 1010st discases, plant								
	quarantine									

	1. Study of vegetation of the university		
	campus.		
	2. Study of ecological modifications of		
	leaves		
Practical	3. Study of woody flora of: Magnoliaceae	30	1,2,3,4
	and Leguminosae		
	<b>4.</b> 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 m		T	SEMESTER -		R – IV ensic Biology								
Course Ti		22DCEC221D		C B10		7F	n	C	n	O/E			
Course co	ae	23BSFS221R	Total credits: 4 Total hours: 45T+30	_	<u>L</u>	T 0	P 2	S 0	R 0	0/F 0	<u>C</u>		
Pre-requi	cita	Nil	Co-requisite		3	U		V   Nil	U	U	4		
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			nd variations among diff						Pilas	es, sp	ccics		
			edge of wildlife forens						iden	tificatio	on of		
			ndangered species, Pug 1	narks,	, and	DNA	techni	iques					
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CO2			bre recovery methods in			nes a	ınd lab	orato	ories,	preven	ting		
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CO4		^	ciency in wildlife forens		•		•	_			n of		
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CO5			omology principles to as										
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Unit-		Cont	tont	('an	toot								
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IV	Introduction, general entomology and arthropod biology, insects of forensic importance, collection of entomological evidence during death investigations, the role of aquatic insects in forensic investigations, Insect succession on carrion and its relationship to determine time since death, 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	10	Apply entomological principles to determine time since death, assess insect succession, and understand entomotoxicology's role in forensic investigations	1,2
V	methods for forensic entomology. Type of wood, leaves, pollens and their identification and comparison. Diatoms: Nature, location, structure, extraction from various body tissues including bone marrow, preparation of slides, methods of identification and comparison, forensic significance	10	Evaluate and apply botanical evidence analysis, including wood identification, leaf anatomy, and pollen structure, for forensic significance.	1,2
Practical	 To examine hair morphology and determine the species to which the hair belongs. To prepare slides of scale pattern of human hair. To examine human hair for cortex and medulla. To carry out microscopic examination of pollen grains. To carry out microscopic examination of diatoms. To cite a crime case in which diatoms have served as forensic evidence. To prepare a case report on forensic entomology. To prepare a case report on problems of wildlife forensics. 	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	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

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Semester			inter/IV Semester							1 4	
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Objective	:5	2. Familiarize stu	•		for d	ruos	in ble	ood 11	irine	and tie	291122
			st-mortem changes	•		_		ou, u	iiiic,	and tis	saucs,
		3. Explore types a						accel	erants	. incen	diarv
		1 2	rensic analysis of	•		•				,	
		4. Provide knowle	•		_		•			l systei	matic
			explosive residue								
		5. Cover analysis									
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CO2		forensic investigat					:	C	.:		.1
CO2		Discuss various la with their practical		ation for ar	ug a	electio	on in	torens	sic coi	mexis a	along
CO3		Develop expertise		rensic analy	rsis s	allowi	no sti	idents	to de	termine	e fire
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CO4		Analyze and into				losive	s, co	ntribu	ıting	to for	ensic
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CO5		Conduct forensic	analysis on beve	rages and i	denti	fy rel	evant	subst	tances	in for	ensic
		scenarios along wi	th their practical a	aspects.							
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I II	Dru tisso the labor Typ Patt Acc Ford Inst of p	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestionatories, drug abuse pes of Fires, and Cauterns of fire Thermoduelerants and incendiensic Analysis of Firesian drugs of	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting ine drug in sports asses of fire, dynamics of fire itary devices, are Debris by forensic Analysis	Contact Hour 8	effet vari fost und sign App dete biod pos rela Ana ider patt ana petr exp	derstancets, and ious sincering lerstanceting logical tended to alyze intifying terns, lysis coleum ertise	nd the nd im ubstar a conding nce porato drugs I sample tem clot drug type and coof fire in proof in fire in f	e class plication nces of the ory tests in disples, a hange abuse cidentic es, can onduc debri lucts, e inve	ifications of a driven densive ir forest sand in spects, a trigory for a showed stigations of the sand showed stigations of th	f ing, ensic t sing issues orts. and nsic casing	1,2
I II	Dru tissi the laborated Force Inst of p	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestipatories, drug abuse ges of Fires, and Causerns of fire Thermorelerants and incendicular and incendicular and methods Firetroleum products	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting ine drug in sports uses of fire, dynamics of fire iary devices, re Debris by forensic Analysis tion and	Contact Hour 8	effection of the state of the s	derstande	nd the nd im ubstar a conding nce corato drugs I sam tem cle drug fire in ng typ and co fire n procein fire explo	e class plication ces of the ory test in disples, a hange cident es, caronduc debri lucts, e invesives,	ifications of a driven densive ir forest sand in spects, a trigory for a showed stigations of the sand showed stigations of th	f ing, ensic t sing issues orts. and asic casing ions.	1,2
I II	Dru tissi the laborated Ford Instead of I	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestionatories, drug abuse es of Fires, and Cauterns of fire Thermoduelerants and incendiensic Analysis of Firumental methods Fortileum products roduction, classificationistry of explosives EDs and their reconstitutions.	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting in drug in sports asses of fire, dynamics of fire itary devices, are Debris by forensic Analysis tion and the various types struction	Contact Hour 8	effet vari fost und sign App dete bio pos rela Ana ider patt ana petr exp Eva clas	derstanders, and derstandersta	nd the nd im ubstar a conn ding nce porato drugs I sample tem cloof fire in g type and coof fire in procession, I system	e class plication ces of the of the ory test o	ifications of n drivensive ir forest transfer address and transfer in spectra and showed stigation their press, and their pre	f ing, ensic t sing issues orts. and asic casing ions.	1,2
I III	Dru tissi the laborated Fore Inst of proceedings of I Medical States of the states of	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestiporatories, drug abuse ges of Fires, and Causerns of fire Thermore elerants and incendification and incendification and incendification products aroduction, classification is graph of explosives elements and their reconstants of explosion chanism of explosion	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting ine drug in sports asses of fire, dynamics of fire itary devices, are Debris by forensic Analysis tion and and their	Contact Hour 8	effection of the sign of the s	derstanders, and ious sidering derstandersta	nd the nd im ubstar a con nding nce porato drugs of tem clot of fire in procein fire in fire explocation, by stem ions of the control of the	e class plication ces of the ory tes of in disples, a cause cident debri ducts, e invesives, IED typatic of expl	ifications of n drivensive ir forests for fferen address and to in spects, uses, at forest showed showed their types, at losive	f ing, ensic t sing issues orts. and nsic casing ions.	1,2
I II	Dru tissi the laborated for pattern of I Mede effer	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestiporatories, drug abuse ges of Fires, and Causerns of fire Thermoduelerants and incendification and incendification and incendification and products roduction, classification in the products and their reconstitution of explosion cts Systematic examination and driving and their reconstitutions of explosion cts Systematic examination and driving and their reconstitutions of explosion cts Systematic examination and driving and	ics, depressants, as designer ate rape drugs, I/urine/biological anges affecting ine drug in sports I/uses of fire, dynamics of fire itary devices, are Debris by forensic Analysis I/urine/biological anges affecting ine drug in sports I/urine/biological anges affecting in sports I/urine/biolog	Contact Hour 8	effection of the sign of the s	derstande	nd the nd im ubstar a conding nce porato drugs I sample tem clot fire in procession from processions of through the processions of the procession o	e class plication ces of the ory test in disples, a classe cident es, care onduct debricuts, e invesives, IED typatic of explight che	ifications of n drivensive ir forest standards and showe stigation their pes, a losive mical	f ing, ensic t sing issues orts. and nsic casing ions.	1,2
I III	Dru tissi the laborated for patt Accordington of patt cherof I Mederate effer exp	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestiporatories, drug abuse ges of Fires, and Causerns of fire Thermograelerants and incendification in the products of the product of the p	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting ine drug in sports uses of fire, dynamics of fire itary devices, are Debris by forensic Analysis tion and their ination of in residues	Contact Hour 8	effection of the series of the	derstanders, and derstandersta	nd the nd im ubstar a community a conding nce porato drugs I sample tem classification in fire exploition, I system ions call throughtal te	e class plication ces of the ory test of the ory the o	ifications of n drivensive ir forest transfer in spectra and showed stigation their pes, a losive mical ues,	f ing, ensic t sing issues orts. and nsic casing ions.	1,2
I III	Dru tissi the laborated for pattern of patte	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestionatories, drug abuse ges of Fires, and Cauterns of fire Thermoduelerants and incendiensic Analysis of Firumental methods Fortroleum products aroduction, classificate mistry of explosives EDs and their reconsticts Systematic examples incompanies and explosionatic and inorganic)	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting and drug e in sports asses of fire, dynamics of fire ary devices, are Debris by forensic Analysis tion and and their mination of a residues by chemical and	Contact Hour 8	effet vari fost und sign App dete bio pos rela Ana ider patt ana petr exp Eva clas con exa resi inst fost	derstanders, and ious sidering derstandersta	nd the nd im ubstar a community a conding nce porato drugs I sample tem clot fire in g type and coof fire in proof in fire exploition, I system ions of through that the profice profice in the profice in the profice in the profice profice in the p	e class plicationes of the ory tests in disples, as hange abuse cident debri lucts, e investives, (ED tynatic of explication change cha	ifications of a drivensive ir forest transfer in spectra and shower stigation their pes, a dosive mical ues, a in spectra and shower in spectra and spectr	f ing, ensic t sing issues orts. and nsic casing ions.	1,2
I III	Dru tissi the laborated for pattern for pa	igner drugs, Narcotinulants, hallucinoger gs, club drugs and driving gs and driving gs detected in bloodues, post-mortem chanalysis of clandestiporatories, drug abuse ges of Fires, and Causerns of fire Thermograelerants and incendification in the products of the product of the p	ics, depressants, as designer ate rape drugs, l/urine/biological anges affecting and drug e in sports asses of fire, dynamics of fire ary devices, are Debris by forensic Analysis tion and and their mination of a residues by chemical and	Contact Hour 8	effet vari fost und sign App dete bio pos rela Ana ider patt ana petr exp Eva clas con exa resi inst fost	derstanders, and derstandersta	nd the nd im ubstar a community a conding nce porato drugs I sample tem clot fire in g type and coof fire in proof in fire exploition, I system ions of through that the profice profice in the profice in the profice in the profice profice in the p	e class plicationes of the ory tests in disples, as hange abuse cident debri lucts, e investives, (ED tynatic of explication change cha	ifications of a drivensive ir forest transfer in spectra and shower stigation their pes, a dosive mical ues, a in spectra and shower in spectra and spectr	f ing, ensic t sing issues orts. and nsic casing ions.	1,2

v	Analysis of alcoholic beverages, country made liquor, illicit liquor and medicinal preparations containing alcohol as constituents. Examination of chemicals used in bribe trap cases	10	Demonstrate skills in the analysis of alcoholic beverages, country-made liquor, illicit liquor, and chemicals used in bribe trap cases, showcasing expertise in beverage analysis and relevant forensic examinations.	1,2
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, 3,4

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

			SEMES'	TER – IV								
Course Ti	itle			ensic Antl	ropo	logy						
Course co	de	23BSFS223R	Total credits:		L	T	P	S	R	O/F	C	
	•	2747	Total hours: 4		3	0	2	0	0	0	4	
Pre-requi		Nil Co-requisite Nil Bachelor of Science in Forensic Science										
Program: Semester	ne	Wir	Bachelor of nter/IV Semeste						mo			
Course		1. Understand the d								OGV W	ith a	
Objective	S	focus on the stud	-		cution	01 1	orensi	C 7 111111	порог	···	Till u	
		2.Learn the nature,	•		or ide	ntific	ation o	f hum	an bo	nes, wi	th an	
		emphasis on estir										
		3.Explore the im	_	-	_					in for	ensic	
		anthropology, par	•		_					faatuma	a and	
		4. Master Somatosc marks for persona			vatioi	ii Oi V	arious	anatoi	mcai .	reature	s and	
		5. Acquire knowled			dices	for m	easure	ments	of dif	fferent	body	
		parts, along with	C	•							•	
CO1		Identify human ske	eleton for estima	ation of ag	e, rac	e, sez	x, and	stature	alon	g with	their	
~~~		practical aspects.										
CO2		Apply personal ide		-		-				_		
		recording anatomical features, scars, occupational marks, and tattoos along with their practical aspects.										
CO3		Illustrate Somatometry measurements and interpret indices for various body parts,										
		contributing to personal identification in forensic scenarios along with their practical										
		aspects.										
CO4		Analyze burned bones and bone fragments in mass disasters.										
CO5	I	Utilize facial recon	struction technic	•	1			<u> </u>				
Unit-		Content		Contact		Lea	rning	Outco	me		KL	
No.	Def	inition, scope and ap	nlication of	Hour	Prof	ficien	tly app	ly the	study	of		
		ensic Anthropology.	•				ones to	-	-			
		nan Skeleton. Nature	•				and st			,		
I	iden	tification of human l	oones.	8	cont	tributi	ng to f	orensi	c		1,2	
		mation of age, race,			inve	estigat	ions.					
		n skeletal material –	skull, pelvis,									
	_	bones.  cortance and need for	r narconal		Apr	dy So	matos	PODV				
	_	tification, cases that	-				s for tl		ervatio	on		
		onal identification.	,, and to quare			_	ding of					
	_	natoscopy – observat	ion of hair on				scars, a					
		· · · · · · · · · · · · · · · · · · ·	ehead, eyes, root of nose, nasal addressing the need for									
II			ge, nasal tip, lips, chin, Darwin's 7 personal identification 1,2							1,2		
		ercle, ear lobes, supra	_									
		siognomic ear breadt umference of head, p										
		marks, occupationa										
		oo marks.	- IIIIIII WIIG									
<u> </u>				l								

Ш	Somatometry – measurements of head, face, nose, cheek, ear, hand and foot, body weight, height. Indices - cephalic index, nasal index, cranial index, upper facial index.  Study of burned bones and bone fragments in mass disasters; Establishment of Partial and Complete identity of skeletal material and dead bodies	10	Conduct Somatometry measurements and interpret indices, contributing to personal identification, and study burned bones in mass disasters for identity establishment	1,2
IV	Facial superimposition techniques, Craniofacial superimposition techniques – photographic superimposition. Facial reconstruction and its importance. Importance of tissue depth in facial reconstruction. Use of somatoscopic and craniometric methods in reconstruction.	10	Utilize facial reconstruction techniques, including facial and craniofacial superimposition, emphasizing tissue depth for accurate reconstructions	1,2
V	Development, scope and role of forensic odontology in mass disaster and anthropology. Introduction to human dentition, structure of teeth, Types and functions of teeth and their comparative anatomy. Estimation of age from teeth.  Bite Marks: Types of bite marks; collection and preservation and photography of bite mark evidence, forensic importance of bite marks.	10	Understand the role of forensic odontology, estimate age from teeth, and analyze bite marks, including their collection, preservation, and forensic importance	1,2
Practical	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. 5) To investigate the differences 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.	30		1,2,3,4

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	1,3
1	along with their practical aspects.	1, 3
	Apply personal identification techniques, including somatoscopy,	
2	for observing and recording anatomical features, scars, occupational	1, 3
	marks, and tattoos along with their practical aspects.	
	Illustrate Somatometry measurements and interpret indices for	
3	various body parts, contributing to personal identification in forensic	1, 8
	scenarios along with their practical aspects	
4	Analyze burned bones and bone fragments in mass disasters.	1, 3, 8
5	Utilize facial reconstruction techniques.	1, 3, 8

		SEMESTER – IV	V							
Course Tit	ele	Techno Professio	onal C	Course	- II					
Course co		Total credits:1	L	T	P	S	R	O/F	С	
		Total hours: 30P	0	0	2	0	0	0	1	
Pre-requi	site Nil	Co-requisite				Nil				
Programm	ne	Bachelor of Science	in Fo	rensic	Scien	ce				
Semester		ter/IV Semester of Seco								
Course		s to the fundamental the					includ	ing clas	ssical,	
Objective	-	gical, and criminal anthro			_					
		e on understanding mo	odus o	perand	i, inv	estiga	tive st	rategies	s, and	
	criminal profiling.	C ' ' 1 1'	, .	. 1 1		1 .				
		pes of crimes, including						_		
	andpsychological	violence, white-collar cri	imes,	juvenn	e den	nquen	icy, an	d their	sociai	
		impacts. sensational crime case st	tudiec	to und	oretan	d real	_world	l annlic	ations	
	of criminological of		tuaics	to und	Cistan	a icai	-work	т аррпс	ations	
		on the structure and hi	ierarcl	v of t	the iu	stice	systen	n and I	ndian	
	investigative agen			-5	J		~, ~ ~ ~ ~			
CO1		Inderstand and apply various theories of criminology to analyze criminal behaviour.								
CO2	Develop investigative	Develop investigative strategies and criminal profiles based on modus operandi.								
CO3		Analyze different types of crimes and their social and psychological impacts.								
CO4	Evaluate sensational c	Evaluate sensational crime case studies to gain practical insights into criminology.								
CO5	Understand the structu	re and hierarchy of the j	ustice	systen	n and	Indiar	inves	tigative	;	
	agencies.									
Unit-	Conten		ntact		Lea	rning	Outco	ome	KL	
No.			lour	<u> </u>				_		
	Basics of Criminology: T			_			lamen			
	classical, positivist, socio	•	theories of criminol					y and		
I	Anthropology, Understan	•	6	their application in analyzing criminal					1.0	
	Operandi, Investigative S Profiling, Role of Media.				viour.		181		1,2	
								1		
	Crime: Deviant Behaviou Organized Crimes, Public						ire and is type			
II	Domestic Violence and V		6	_			is type g devia			
11	Violence,	VOIKPIACE	U			_	hite-c			
	v Totelice,			crime		una v	inte e	Onui	1,2	
	White Collar Crimes, Juv	renile				e natı	ire and	1		
	Delinquency, Victimolog						is type			
III	and Crime, Psychologica	l Disorders and	6	_			g juver		1,2	
	Criminality.			delin	quenc	y and	white	-		
				colla	r crim	ies				
	DIFFERENT SENSATI	ONAL CRIME					rn fro			
III	CASE STUDIES: Murde	er & Killings,	6			l crim	e case			
111	POSCO, Rape cases, biza	*	U	studi	es				1,2	
Ī	crimes, criminal defamati	ion, Scandal.								

	Justice System & Investigative agency:		Understand and describe the	
	Types of court, Hierarchy of court &		hierarchy and functions of	
IV	justice, Introduction to Indian investigative	6	the justice system and Indian	1,2
	agency Hierarchy of Different	U	investigative agencies	
	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				

	SEMESTER – IV												
Course	Title			glish for	emp	loyabil	lity						
Course	code	23UBPD222R	Total credits:		L	T	P	S	R	O/F	C		
			Total hours:		0	0	4	0	0	0	2		
Pre- rec		Nil	1										
Program			Bachelor										
Semeste	er			nester of First year of the programme									
Course		1. To acquaint stu					•						
Objecti	ves	2. To acquire the s	-	instruct, i	nflue	ence, e	ngage,	educat	e, or				
			<ul><li>appease thelisteners.</li><li>3. To increase proficiency, present ability and quality of resume and provide guidance</li></ul>										
		_		-				ume an	d provi	ide guida	ince		
		forself- promoti											
		4. To prepare and											
CO	1	Enable students to practice public spe			ına r	ionvert	vai cue	s, over	come I	cai, and			
CO	,	Equip students wit			it o	nd sere	en rec	ımes o	nd cov	ar lettere			
CO		Teach students the											
		Prepare students for	_								cs.		
CO	4	participating in mo	-	-	ى ي	,,,,,,,,()()	ij usik	ca que	,os a				
Students will understand the concept of conflict management, identify						ify dif	ferent tyr	oes.					
CO	5	and analyze its effe		-F	or commet management, rachery arretent types,								
Unit-	Init-			Contact	t		r •	0	4		171		
No.		Content		Hour		1	Learm	ng Ou	tcome		KL		
		c Speaking Skills			St	udents	will b	e able t	to creat	e			
		reparation of Scripts			effective speaking scripts, interp nonverbal cues, manage public				_				
		nderstanding Nonve	rbal cues of										
I		ublic Speaking	_	7	_	-		-	practic		3, 4		
		nderstanding and O	-		ef	fective	speak	ing tec	hnique	S.	,		
		ear of Public Speaki	-										
		ractice strategies of	Public										
		peaking ical session on Res	ıma and		Students will prepare submit					t and			
		icai session on Resi r letter	me and		Students will prepare, submit, an evaluate resumes and cover letter								
		r <b>letter</b> paration, submission	& screening		61	aruale	108uiil	cs allu	COVELI	cuels.			
II	^	Resume.	a screening	5							3		
	_	ctical session on co	ver letter										
		eening session											
		l Etiquettes			St	udents	will u	ndersta	nd the				
III		fferent Parts of Ema	il and Usage	5	st	ructure	of em	ails an	d draft	them	2, 3		
		afting emails effecti	_		ef	fective	ly.						
	Interv	iew Skills (Mock se	ssions)		St	udents	will a	nswer	commo	n			
IV		eparing Commonly	nsked	7			_			tly and	3, 5		
1,4		erview Questions		<b>'</b>	pe	erform	well in	mock	intervi	ews.	3, 3		
		ock Interview sessio	ns										
		ct Management			Students will understand t				_				
v		finition		8				-	nt, ider	•	2, 4		
,		pe of Conflict Mana	-				types,	and ar	alyze i	ts	_, .		
	iii. Eff	fects of Conflict Ma	nagement		effects.								

**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:**

 $\underline{\text{https://www.aplustopper.com/active-and-passive-}} \ \underline{\text{voice-rules/https://www.edudose.com/english/direct-and-indirect-speech-rules/}} \ \underline{\text{voice-rules/https://www.edudose.com/english/direct-and-indir$ 

	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 – I	V										
<b>Course Title</b>		Digital I	Literacy	7									
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				N	il						
Programme			ce in Forensic Science										
Semester		V Semester of Fir											
Course		o identify and an	analyze computer hardware, software and										
Objectives	their uses.		_										
	2. Students will be able to												
	3. Students will be able to		ficiently	y foi	r requii	red in	forma	tion as w	ell	as			
801	for digital financial trans												
CO1	Understanding of Computer						lıng.						
CO2	Apply MS-Office to solve b												
CO3	Operate the Internet, social					ntly ai	nd eth	ically.					
CO4	Analyse the cybercrimes on	<u> </u>						1 1 101					
CO5	Explore the functionality an	id use of credit car											
Unit-	Content		Contac	et	I	Learn	ing O	outcome	K	<b>KL</b>			
No.			Hour				0 1						
	Fundamentals of Comput	=			_			amental					
	Components of a Comput				of com	iputer	syste	ms.					
	functions. Different Types												
	and their applications.												
_	Lab Experiment:	c											
I	• Identify the Components	_	6										
	and their Functions and di	• •											
	Computers and their App												
	Demonstrate the usage of	•							1	1,2			
	devices and identify vario	_							1	.,2			
	system file management of Introduction to MS-Office				Dagari	ha tha	funa	tions on					
	Components of theMS-Off				differe		tool						
	Creating documents with							ike MS-					
	Creating documents with Creating Presentations with				Excel,								
	PowerPoint., Creating Spre				LACCI,	W155-	word	, e.c.	1 '	,2,3			
	MS-Excel.	adsirects with							1,	2,3			
	Lab Experiment:												
	<ul> <li>Demonstrate how a docu</li> </ul>	iment to be											
	prepared and formatted												
II	<ul> <li>Create casual application</li> </ul>		6										
-	leave because of family	•	Ū										
	ceremony using Word P	-											
	Create a curriculum vita												
	Word. 4. Creating a time	_											
	MS – Word.	caute with											
		on Commonanta											
	Design PPT on Compute using different effects as	_											
	using different effects su												
	Design, Record etc., on	SHUCS.											
	1								1				

	'			
	Design PPT on Computer Components using different effects such 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.			
III	Creation and use of Email Accounts.	6		
	Cyber Crimes.	v		1,2,3
	Lab Experiments:			1,2,0
	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.		T 1 1 1 6	
	Introduction to social media: The Power of social media, Relevance of		Explain the power of	
	social media in present scenario.		social media their	
	Creating accounts and using some		relevance and adverse	
	popular social media portals and Apps		effects to over using it.	
	like WhatsApp, Facebook, Twitter,			
	Instagram, and LinkedIn. Social Media			
IV	Etiquettes.	6		1,2,3,
	Lab Experiments:			4
	Creating an account of some popular     cocial media metals and Appa like			
	social media portals and Apps like LinkedIn, Facebook, Twitter, and			
	Instagram.			
	Creating an accounts of digital payment			
	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.			
	<ul><li>Lab Experiments:</li><li>Create online Google form and learn how</li></ul>			1,2,3,
V	togive online test.	6		4,5
	Creating an account of Online Shopping			7,5
	sites like Amazon, flipkart, eBay etc.			
	Understand the			
	• journey of customer to buy and sell on			
	online shopping sites.			
	· ·			

T1: Sinha Pradeep K. and Priti Sinha "Computer Fundamentals: Concepts Systems & Applications" 3rd 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												
Course Title Basic acclimatizing skills												
Cours	e code	23UULS221R	<b>Total credits: 1</b>		L	T	P	S	R	O/F	С	
Total hours: 15		5 T	1	0	0	0	0	0	1			
Pre-requisite		Nil	Co-requisite	e				N	Vil			
Progra	amme	Bachelor of Science in Forensic Science										
Semes	ter	Winter/ 4th semester of second year of the program										
Cours	e	1. To impart knowledge of the fundamentals of Hospitality industry and its										
Object	tives	applications.										
		2. Students will be able to familiarize with the cooking equipment's & Utensils.										
		3. Students will be able to handle different modes of reservations.										
	01	Students will have basic knowledge of cooking methods.										
	02	Students will gain the knowledge of organizing & Cleaning of Rooms.										
	03	Students will be able						-				
C	<b>D4</b>	Students will be able	to acquire the kno	owledge	of ba	sic ho	ouseh	old's	amen	ities for	day-	
~	25	to- day use.	1 . **			1 (*						
C	<b>O5</b>	·	s will develop an understanding of personal financial management and									
Unit-		budgeting skills.  Content		Contac	4		Loor	mina	Outc	0.000.0	KL	
No.		Content		Hour	ı		Leai	ming	Oute	ome	KL	
	Introd	Introduction to Accommodation				Expla	ins 1	the to	echnic	ques of		
	Manag	gement			accor	nmod	lation	mana	gement.			
	• Telep	ephone handling technique										
I	• Orga	nizing of Rooms.	3							1,2		
1	_	ning agents.	3							1,2		
		ning equipment's and u										
			.ses.									
		making Process.				Inter	1,,,,,,	tha f	ın dan	aantala		
		mentals of Cooking	0- Ohioatinos of			Introduces the fundamentals of cooking including efficient						
		nition of cookery–Aim			and safety methods.							
II	cook	•	3							1,2,3		
		of basic Cooking equip										
		onal Hygiene and Safet of Fire & Fuels										
		ods of Cooking				Illust	rates	diffe	rent 1	methods		
		erent Cuts.				Illustrates different method of cooking.						
Ш		of Herbs and Spices.	3			C				1,2,3		
***		c Food and Beverage Pr								1,2,3		
		onal food Habits										
		s & Format's			Expla	ins a	nd illı	ıstrate	es			
	• C –fo	orm			vario	us for	mats	of wr	iting			
	• Rese	rvation form	_		forms	like	reser	vation	١,	1,2,3,		
IV	• Regi	stration form	3		passp	ort, e	tc.			4		
	-	port Application form I										
		Agreement										

	Introduction to Accommodation		Explains the techniques of	
	Management		accommodation management.	
	Telephone handling technique			1 2 2
$\mathbf{V}$	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						

C 70°41		SEMESTER - IV								
Course Title			Chemistry.		т.	C	m	0/5		٦
Course code	23FSCH225R	Total bourge 20T + 20	$\frac{L}{2}$	T	P	S	R	O/F	(	
D	- NIL	Total hours: 30T + 30	0P 2	0	2	0	0	0	3	•
Pre-requisit	e Nil	Co-requisite	iones in E	onoma*	o Coio	Ni	<u>I</u>			
Programme Semester		Bachelor of Science in Forensic Science								
Course	1. Study syntl	Winter/ 4th semester of second year of the program  1. Study synthesis and reactions of aldehydes and ketones.								
Objectives		properties and reactivit	•			ıd deri	vative	es.		
Sojectives		nodynamic principles ar	•	•		ia acri	· ccci · ·			
		nciples of molecular spe								
	5. Analyze Ra	aman and electronic spec	ctral transit	ions.						
CO1		d gain knowledge abo								
		rbonyl compounds such	as aldehy	des and	l ketoi	nes alc	ong w	ith the	ir nam	ned
602	reactions.	1 ' 1 1 1 1	1	. 1	. ,				1 '	1
CO2		d gain knowledge abo	-	_	-					
		rboxylic acids and their	derivative	s such	as acı	id chic	orides	, ester	s, ami	des
002	and acid anhyd			1 .1					1 .	
CO3		basic principle of spec			varıou	is spec	trosc	opic te	chniqu	ues
CO4		ne motion of different me basic principle of spec			varion	ic cnaa	trosc	onic to	chnia	1160
CU4		ne motion of different m			v ai 10t	is spec	uosc	opic te	ciniq	ues
CO5		molecular techniques a			man a	nd ele	ctroni	ic spec	trosco	pv.
Unit-No.		ontent	Contact	Learning Outcome					KL	
			Hour							
	Aldehydes and Ke		_	Explain aldehyde and						
	Nomenclature and		keton	e reac	tions					
	carbonyl group, S	earbonyl group, Synthesis of aldehydes								
	and ketones with p									
	the synthesis of al									
	chlorides, synthes									
	ketones using 1,3-									
	ketones from nitri									
	acids. Physical pro									
	Mechanism of nuc									
	carbonyl group wi									
	of Benzoin, Aldol									
I	Knoevenagel cond		10						1.2	
1	-	Condensation with ammonia and its							1,2	
		erivatives, Wittig reaction, and								
	Mannich reaction.									
		Jse of acetals as protecting								
	group.Oxidation o									
	Villiger oxidation									
		emmensen, Wolff-								
	Kishner, LiAIH4									
	NaBH4reductions enolizable ketones	-								
	and ketones, Mich	unsaturated aldehydes								
	and Ketones, Iviich	acı auuluul.								
				1				I		

SEMESTER – IV

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	8	Describe carboxylic acid properties	1,2
III	Basic).  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	10	Interpret rotational and vibrational spectra.	1,2

	bond length, qualitative description of non-rigid rotor, isotope effect.  Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic 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.			
V	Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of $\sigma$ , $\pi$ and n M.O.their energy levels and their respective transitions.	7	Analyze Raman and electronic spectra	1,2
Practical	<ol> <li>Perform a nucleophilic addition reaction to synthesize benzoin from benzaldehyde using potassium cyanide as a catalyst.</li> <li>Study the Cannizzaro reaction by reacting a non-enolizable aldehyde (e.g., formaldehyde) and determine the products.</li> <li>Study the rotational spectrum of a diatomic molecule like HCl or DCl to determine bond length and verify the rigid rotor model.</li> <li>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.</li> </ol>	30		1,2,3,4

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

		<b>I</b>	SEMESTER – I							
Course T		44FGDYY44 (D		ics- 4	75				0.75	
Course c	ode	23FSPH226R	Total credits: 3 Total hours: 30T + 30P	L 2	T 0	P 2	S 0	R	0/F 0	<b>C</b> 3
Pre-requ	icita	Nil	Co-requisite	<u></u>	U		Nil	U	U	3
Program		1411	Bachelor of Science	in Forens	ic Scie	ence	1111			
Semester		,	Winter/ 4th semester of se				gram			
Course			the structure and bondin							
Objective	es		e vibrations, phonons, an					nateri	als.	
			arization, semiconductor							
		principles.			-		_		-	
		4. Learn therm	nodynamic laws and their	applicati	ons.					
		_	netic theory, blackbody	y radiatio	n, an	d st	atistic	al m	echan	ics
		concepts								
CO			t crystal structure and phon	ions						
CO2		Discuss about su								
CO3			wledge of semiconductor a		onducto	or				
CO4			ne basics of thermodynamic		1	•	1			1
COS	)	thermodynamic p	various quantities related	to thermo	odynan	nics,	sucn	as en	tropy	and
Unit-			ntent	Contact	Lo	orni	ng Ou	toomo	T TZ	L
No.		Co	ntent	Hour	Le	ai IIII	ıg Ou	tcome	1	L
1100	Amo	orphous and crysta	Illine materials, lattice	11041	Desc	ribe o	crystal	line		
		•	ice with a basis, unit cell,				and bo			
			n, reciprocal lattice, types							
I of la			nes, lattice planes and	7					1	1,2
I of mi Br			on of x-rays by crystals, onds, ionic bond, covalent							
		g s iaw types of bi , Van der Waal's l								
			bration and phonon,		Expl	ain la	ttice			
			phonons, Einstein and			ations				
	Deby	e theories of spec	ific heat of solids. Dia-,		magi	netisr	n			
II			agnetic materials, Curie's	5					1	1,2
			ferromagnetism and	5						
		•	etic domains, discussion is and energy loss.							
					** 1					
			ility, electric susceptibility,			erstar	id uctor a	n d		
		•	tric polarizability,				lucting			
			N type) and insulator.			erties		,		
		•	onductor, mobility, Hall							
III	Effec		I 1 T II	8					1	1,2
		sner effect, Type-	on's equation and	U						
			ope effect, idea of BCS							
	•		cooper pair and coherence							
	lengt	•	• •							
	Zero	th Law of thermo	dynamics and temperature.		App	ly the	rmody	namio		
	First	law and internal e	nergy, Applications of	5			ocesse			
			ation between CP and CV,							
IV			and Adiabatic Processes,						1	1,2
			ot's cycle & theorem,							
			namics, Unattainability of							
		ute zero.			<u>L</u>					
					•					

	Derivation of Maxwell's law of distribution of		Analyze kinetic theory	
	velocities, mean free path (Zeroth Order),		and blackbody radiation	
	Viscosity, Conduction and Diffusion Law of			
	equipartition of energy (no derivation), mono-			
$\mathbf{v}$	atomic and diatomic gases. Blackbody radiation,			1.2
·	Spectral distribution, Planck's law, Wien's	5		1,2
	distribution law, Rayleigh, Jeans Law, Stefan			
	Boltzmann Law, concept of Phase space,			
	Macrostate and Microstate, Entropy and			
	Thermodynamic probability			
	1. Verify Bragg's law by studying the diffraction			
	pattern of X-rays using a crystal (e.g., NaCl).			
	<b>2.</b> Measure the Hall voltage and determine the			
	carrier type (P or N), carrier concentration,			
	and mobility in a semiconductor sample.			
Practical	<b>3.</b> Trace the B-H curve for a ferromagnetic			1,2,
Tactical	material and calculate the energy loss due to			3,4
	hysteresis.			
	<b>4.</b> Determine the specific heat of a solid using			
	the Debye or Einstein model experimentally.			
	<b>5.</b> Determine the viscosity of a gas by measuring			
	its flow through a capillary tube.			

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								
Course Titl				Biology-		I		T	1		
Course code	e	23FSBO227R	Total credits: 3		_ <u>L</u> _	T	P	S	R	O/F	C
D · ·		NT*1	Total hours: 30		2	0	2	0	0	0	3
Pre-requisit		Nil	Co-requi Bachelor of		Fores	agia S	oiono	Nil			
Programme Semester	5	V	inter/ 4th semes						m		
Course			knowledge on dif						111		
Objectives									es in	mainta	aining
		-	. To provide the information regarding role of hormones, enzymes in maintaining physiological homeostasis.								Ü
		_	knowledge rela	ted to var	ious	func	tions	of 1	respir	atory	and
		endocrine gla									
CO1		Understand the ph									
CO2		Discuss the mecha									
CO3		Illustration of nerv	e and its impulse	propagation	n and	differ	ent aı	nimal	tissues	S	
CO4		Understand the ba	sics of human rep	productive s	ystem	and e	ndoc	rine s	ystem.		
CO5		Discuss and classi	fication of enzym	es, its mech	anisn	n and	cell b	iology	7		
Unit-No.		Conter	nt	Contact Hour		Lear	rning	Outo	ome		KL
I	Cardiovascular System: Composition of blood, Basic Structure of Human Heart, Origin and conduction of the heartbeat, Cardiac cycle.  Excretory System: Nephron-Structure and Functions, Mechanism of Urine formation, Counter-current Mechanism			5	phy and	siolog excre	y of Control of tory s	Cardic ystem	and the	lar man	1,2
п	ve Tr Di dig Al	espiratory System: Intilation, Mechanis ansport of respirato gestive System: Progestion in the alime psorption of carbohyoteins, fats	m of breathing, ry gases ocess of ntary canal;	7	excl	mecha hange, absor	proc	ess of	seous diges	tion	1,2
Ш	Nerve and muscle: Structure of a neuron, Resting membrane potential, Origin and conduction of nerve impulse in myelinated and non-myelinated nerve fibres. Introduction to animal tissue, types of animal tissue, sliding filament theory.			6	Students will know regarding nerve and its impulse propagation and different animal tissues				ng	1,2	
IV	Ph fer St	eproduction and Enc sysiology of male re male reproductive s ructure and function ands and their horm	eproductive and ystem, of endocrine	5	und repr	dents verstan	ding o	of hur stem	nan		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	<ol> <li>Study of different bones using disarticulated skeleton of fowl/rabbit</li> <li>Study of different developmental stages of frog using permanent slides.</li> <li>Study of developmental stages of Chick embryo using permanent slides.</li> <li>Preparation of human blood smear and study on morphology of blood cells.</li> <li>Preparation of temporary slides of animal tissues: Epithelial, Skeletal and Cardiac</li> </ol>	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								
Course T		AADGEGAAAD		nsic Se						0.75	~
Course co	ode	23BSFS311R	Total credits: 4 Total hours: 45T+3		L 3	T 0	P 2	<u>S</u>	R 0	0/F 0	C 4
Pre-requi	icita	Nil	Co-requisite	OUF .	3	U	4	 Nil		U	4
Programi		INII	Bachelor of Scie	ence in	For	·ensic	Scier				
Semester			Fall/V Semester of the						ne		
Course		Understand t	he immune system, in							nd the	role of
Objective	es		tenes, and adjuvants ir						,,		
		2. Explore the ty									
			e process of raising an								
			forensic significance		ns, s	serolo	gical	reage	nts, ar	nd met	hods of
			sed in serological wor intigen-antibody reac		inc	ludina	n pro	oinitot	ion	o a alut	ination
			and immunofluoresce		IIIC	Iuuiii	g pred	лрна	1011,	aggiui	manon,
			applications and pote		itfa	lls of	the F	ILA s	systen	n in pa	aternity
		testing.		1						•	•
CO1	l	Explain immune	system, innate and a	cquired	l im	muni	ty, an	d the	role (	of anti	gens in
		forensic contexts.									
CO2			chemical properties,						_		s, and
		demonstrate the a	bility to raise antisera	along	with	their	practi	cal as	pects	•	
CO3	}	Apply lectins in fo	Apply lectins in forensic settings, utilizing serological reagents and explain methods of								
		sterilization for serological work along with their practical aspects.									
CO4	ļ	_	antigen-antibody rea		ino	cludin	g pre	cipita	tion,	agglut	ination,
		•	immunofluorescence.								
CO5	5	Assess the applic	ations and potential p	oitfalls	of t	the H	LA sy	stem	in pa	ternity	testing
	1	scenarios		1		1					1
Unit- No.		Conte	ent	Conta Hou		-	Learn	ing C	Outco	me	KL
			ne response, innate			Und	lerstar	d the	immı	ine	
		equired immunity	and antigens,			-				quired	
		enes and adjuvants. unoglobulin: Types	nhysio-chemical				nunity				
			raising of antisera.				wledg	e to fo	orensi	c	
			cance, buffers and			scer	narios				
Ι		ogical reagents, me		8							1,2
			or serological work.								
		•	tions: Precipitation,								
		tination, complement anofluorescence.	ent, neutranzation,								
		system: Its applica	ations in paternity								
		g, pitfalls of HLA									
	Bloo	d: Identification (Pr	reliminary and			Den	nonstr	ate pr	oficie	ncy in	
	confi	rmatory tests), spec	cies of origin			und	erstan	ding,	classi	fying,	
	(Imm	nunodiffusion and				and	utilizi	ng			
	Imm	unoelectrophoresis)	), Individualization:			imn	nunog	obuli	ns for		
		d grouping, enzyme				fore	ensic a	nalysi	S		
II		men: Composition,		7							1,2
	_		ozoa, Identification								
		iminary and confire	· · · · · ·								
		ding Azoospermic									
		·	d Grouping, seminal								
	fluid	isozymes typing.									

	3. Composition, functions and forensic significance of saliva, sweat, milk, urine, faecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH			
III	Introduction- History of DNA Typing, 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	Apply lectins with an 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	<ol> <li>To determine blood group from fresh blood samples.</li> <li>To determine blood group from dried blood sample.</li> <li>To carry out the crystal test on a blood sample.</li> <li>To identify blood samples by chemical tests.</li> <li>To identify the given stain as saliva.</li> <li>To identify the given stain as urine.</li> <li>To carry out cross-over electrophoresis.</li> <li>To study the correlation between impact angle and shape of bloodstain.</li> <li>To identify the point of convergence from the bloodstain patterns.</li> </ol>	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

			SEMES	TER – V							
Course Ti	itle		F	orensic To	xicolo	gy					
Course co	ode	23BSFS312R	Total credits: 4	ı	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					Nil			
Programi	ne		Bachelor of	Science in	Fore	ensic S	cienc	e			
Semester			Fall/V Semester	of third y	ear of	f the p	rogra	mme			
Course		1. Introduce students to poison classification, signs of drug addiction, drug toxicity, and									
Objective	S	methods for extracting poisons from biological specimens.									
		2. Explore pharmacology and toxicology of psychotropic drugs, including sedatives,									
		_	ates, and drugs o								
		3. Cover the nat		-	symp	otoms,	and	detect	tion c	of corr	osive
		-	c, mercury, and l								
		4. Explore pestic				and es	timati	on, as	well	as vo	latile
		•	ethyl alcohol and								ı
		5. Introduce stud							alysis	, breat	n test
			nd asphyxiants lil	•						1	
CO1		Understand the fo						•	and a	nalyze	toxic
CO2			substances in forensic contexts along with their practical aspects.								
CO2		Explain the effects of psychotropic drugs and their implications in forensic investigations along with their practical aspects.									
CO3 Interpret metallic poison analysis						10001 6	ngnaat	0			
	CO4 Analyze non-volatile and volatile								and a	contrib	uting
004		to forensic investi	-			_		CIICCI	s and v	COIIIIIO	utilig
CO5		Analyze miscella	-					inatio	ı in c	omples	z and
		rare cases	neous poisons ec	mulouting	10 101	CHSIC	CAUIII	matioi	1 111 0	ompiez	Y and
Unit-		Content	t	Contact		Lea	rning	Outo	ome		KL
No.				Hour				,			
	Clas	sification of poison	s, drug		Prof	icient	y idei	ntify, c	classif	y,	
	addio	ction and its signs a	and		and	isolate	poise	ons,			
I	symį	otoms, drug toxicity	y. Extraction	8	dem	onstra	ting a	n unde	erstan	ding	1,2
	and i	solation of poisons	from viscera		of d	rug ad	dictio	n sign	s and		
	and o	other biological spe	cimen		sym	ptoms					
		macology and toxic			App	ly kno	wledg	ge of			
	-	hotropic Drugs: Se				chotrop		-			
II	Stim	ulants, Opiates and	drugs of	7		wcasin					1,2
	abus	e <b>.</b>				itives,			opiate	s,	
						drugs					
		re, administration,	-			lyze n		_			
		otoms, fatal dose, p			_	ertise i				ds,	
III	findi	ngs, detection and	~	10	_	morte		_	and		1,2
					mad	lico-le	~o1 oc	nacte			
	_	cts of-Corrosive po			IIICU	100-10	garas	pecis.			
	alkal	is, Arsenic, Mercui	ry, Lead.								
	alkal Vari	is, Arsenic, Mercurous pesticides, isola	ry, Lead. ation,		Sho	wcase	profic	ciency			
	alkal Vario	is, Arsenic, Mercurous pesticides, isolation and estimation	ry, Lead. ation, 1,		Sho	wcase tifying	profic g, dete	ciency ecting,	and		
IV	alkal Vario detect Vola	is, Arsenic, Mercurous pesticides, isolation and estimation tile Poisons: methy	ry, Lead. ation, n, rl alcohol,	10	Shoriden estin	wcase tifying	profic g, dete	ciency ecting,	and e and		1,2
IV	alkal Vario detec Vola chlor	is, Arsenic, Mercurous pesticides, isolation and estimation tile Poisons: methyroform. symptoms,	ry, Lead. ntion, n, l' alcohol, post-mortem	10	Shoriden iden estir vola	wcase tifying nating	profices, determined	ciency ecting, volatil	and e and nasizir	ng	1,2
IV	alkal Vario detec Vola chlor findi	is, Arsenic, Mercurous pesticides, isolation and estimation tile Poisons: methy	ry, Lead. ation, n, rl alcohol, post-mortem ction and	10	Shoriden iden estir vola	wcase tifying	profices, determined	ciency ecting, volatil	and e and nasizir	ıg	1,2

	Animal poisons, plant poisons, analysis		Demonstrate expertise in	
	of blood for alcohol, breath test		analyzing various poisons,	
	instruments, Asphyxiants Cyanide,		including animal and plant	
V	Carbon monoxide	10	toxins, breath tests for alcohol,	1.2
•		10	and detecting asphyxiants like	1,2
			cyanide and carbon monoxide,	
			showcasing proficiency in	
			toxicological	
	1) Isolation techniques of different			
	toxic substances.			
	2) TLC of insecticides, Barbiturates			
	and other drugs.			
	3) Analysis of volatile and non-volatile			
	poisons.			
	4) Analysis of vegetable poisons.			
Practical	5) Spot test of nitrates, nitrites,	30		1,2,
Tactical	carbonates, sulphates, sulphites,	30		3,4
	chlorates.			
	6) Spot test of mercury, iron, copper,			
	Aluminum and cadmium and zinc and			
	other metallic			
	poisons.			
	7) Determination of alcohol in blood			
	and urine sample			

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 2 0
3	examination in complex and rare cases.	1, 3, 8

			SEM	IESTER – Y	V						
Course Ti	itle		Adva	anced Instru	umenta	al Ana	alysis				
Course co	ode	23BSFS313R	Total credit	s: 3	L	T	P	S	R	O/F	С
			<b>Total hours</b>	: 30T+30P	2	0	2	0	0	0	3
Pre-requi	site	Nil	Co-req	uisite				Nil			
Programm	ne		Bachelo	r of Science	in Fo	rensic	Science	ce			
Semester			Fall/V Seme								
Course		1. Introduce stude	-		-		_			-	LC),
Objective	S	emphasizing th	_	_							
		2. Explore UV-	•	•	•		spec	tropho	tometr	y, Ra	ıman
		spectroscopy, A  3. Introduce neutr		_		-	thoory	inctm	mantat	ion on	d tha
		detection and n		-	-		-			ion, and	u tiic
		4. Cover transmi		-	-					microso	copy
		(SEM), X-ray			-			-			
		their forensic a	pplications.								
		5. Introduce princ	_					_			
		centrifugation,		entrifugation	i, and a	analysi	s of su	b-cellu	ılar fra	ctions u	ısing
001		ultra-centrifuge		1 ' 1 1'		) (C	11.0	<b>1</b>	<u> </u>		1 .
CO1		Describe chromate			ng GC	-MS a	na LC-	MS, 10	r foren	isic ana	lysis
CO2		along with their practical aspects.  Utilize various spectroscopic techniques for qualitative and quantitative forensic analysis									
C02		along with their practical aspects.									
CO3		Apply knowledge of neutron activation analysis for qualitative and quantitative forensic									
		investigations.									
CO4		Apply knowledg					_				ensic
		examinations for material and evidence analysis along with their practical aspects.									
CO5		Develop skills in applying centrifugation techniques for the separation and analysis of									
Unit-	<u> </u>	biological and for	ensic samples	Contact		Las	rning (	Outon	<b></b>		KL
No.		Content		Hour		Lea	rning (	Jutco	ine		KL
110.	Gas	chromatography, 7	Theoretical	Hour	Demo	onstra	te expe	rtise ir	n gas ai	nd	
		ciples, instrumenta					matogr		•		
	•	nnique, columns, sta			•		princip				
	pha	ses, detectors, Pyro	lysis GC,		techn	niques	for for	ensic a	nalysis	S.	
I		-MS, Forensic appl		7							1,2
	_	uid chromatography									
		riew of theory, Instr	-								
		hnique, column, de									
		Forensic application Visible spectropho			Annl	y knor	wledge	of var	ione		
		ared spectrophoton	•			•	oic tech				
		ctroscopy, AAS, A	•		•	•	alysis,	•		7_	
II	^			5			ctroph		-		1,2
					1	_	ectroph		-		
						_	ctrosco		AS, AE	ES,	
					and n	nass s	pectron	netry.			

III	Introduction, Review, Basic theory and principles, Instrumentation-Various neutron sources, Detection and measurement of Gamma-rays for qualitative and quantitative analysis, Forensic Applications	8	Apply neutron activation analysis principles for qualitative and quantitative analysis in forensic applications.	1,2
IV	TEM SEM, X-Ray techniques, X-ray Diffraction (XRD), X-ray Fluorescence (XRF and Forensic Applications	5	Analyze and interpret forensic samples using advanced microscopy techniques, X-ray diffraction, and X-ray fluorescence.	1,2
V	Basic principles of sedimentation, Various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Analysis of sub-cellular fractions, Ultra-centrifuge- Refrigerated Centrifuges.	5	Demonstrate proficiency in centrifugation principles, techniques, and applications for sub-cellular fractionation in forensic science.	1,2
Practical	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 HPLC/LCMS 5) To analyse sample using GC-HS 6) To analyse sample using compound microscope 7) To analyse sample using comparison microscope	30		1,2,3,

**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	1, 3, 8
	evidence analysis along with their practical aspects	
5	Develop skills in applying centrifugation techniques for the	1 2 9
5	separation and analysis of biological and forensic samples.	1, 3, 8

				ESTER – V							
Course T				no Professi					1		
Course co	ode	23BSFS314R	Total cred		L	T	P	S	R	O/F	C
D	•-•4-	NT21	Total hour		0	0	2	0	0	0	1
Pre-requisiteNilCo-requisiteProgrammeBachelor of Science in Fo							Catan	Ni	Ш		
Program Semester		Wi	nter/IV Sem						mo		
											d usas
Course 1. Introduce students to the instrumentation, principles, working mechanisms, of tools in DNA laboratories.						sins, an	a uses				
Objective	65	2. Educate students			and me	thodo	ologies	used	in tox	icology	7
		laboratories, em						usea	in tox	icology	
		3. Familiarize with						graph	ıv labo	ratories	and
		understand their					1	<i>6</i> 1	,		
		4. Acquire skills in			for finge	erprin	t analy	sis aı	nd que	stioned	
		document exam									
		5. Integrate theoret			actical a	applica	ations	in for	ensic i	nvestig	ations
		using laboratory									
CO	L	Understand the instr	rumentation,	principles,	and app	licatio	ons of	tools	used i	n DNA	
003	•	laboratories. Gain comprehensive	lznowloda-	of the inst	umanta	and to	ohn:	1100 01	nnlor.	nd in	
CO2	4	toxicology laborator		of the mstr	uments	and te	ciiiiq	ues ei	прюує	ea m	
CO3	<b>,</b>	Analyze different ty		s and their	social ai	nd nsv	cholo	oical	imnacı	ts	
CO4		Evaluate sensational									
COS		Understand the struc									
		agencies.		, , , , , , , , , , , , , , , , , , ,	3	<i>J</i>				8	
Unit-		Con		Contact	t Learning Outcome					TZT	
					]	Learn	ing O	utcoi	me		KL
No.	Inctm	tent		Hour					me ———		KL
		tent uments used in DNA			Maste	r the u	ise of	PCR,	me ——		KL
	Labo	tent uments used in DNA ratory: Instrumentation			Maste	r the u	ise of	PCR,			
No.	Labo	tent uments used in DNA		Hour	Maste electro	r the uophore	ise of	PCR,			1,2
No.	Labo princ	tent uments used in DNA ratory: Instrumentation iple, working anduse	s.	Hour	Maste electro spectro analys	r the uphore	ise of esis, ar	PCR, nd rs for	DNA		
No.	Labo princ	tent uments used in DNA ratory: Instrumentation iple, working anduse uments used in Toxic	s. ology	Hour	Maste electro spectro analys	r the uphore ophotosis	ise of a sesis, and ometer	PCR, nd rs for	DNA ect tox	ins	
No.	Labo princ Instru Labo	tent  uments used in DNA ratory: Instrumentation iple, working anduse  uments used in Toxic ratory: Instrumentation	ology on,	Hour 6	Maste electro spectro analys	r the uphore ophotosis	ise of a sesis, and ometer	PCR, nd rs for	DNA ect tox	ins	1,2
No.	Labo princ Instru Labo	tent uments used in DNA ratory: Instrumentation iple, working anduse uments used in Toxic	ology on,	Hour	Maste electro spectro analys	r the upphore ophotosis technical	ise of esis, are ometer iques to	PCR, nd rs for	DNA ect tox	ins	
No.	Labo prince Instru Labo prince	tent  Imments used in DNA ratory: Instrumentation iple, working anduse  Imments used in Toxical ratory: Instrumentation iple,working and use	ology on, s.	Hour 6	Maste electro spectro analys Learn using immun	r the upphore ophotosis technical GC-M	ise of a sesis, are cometer iques in the sesis in the sesion in the sesis in the sesis in the sesion in the	PCR, and	DNA ect tox		1,2
No.	Labo prince Instru Labo prince	tent  uments used in DNA ratory: Instrumentation iple, working anduse  uments used in Toxic ratory: Instrumentation	ology on, s.	Hour 6	Maste electro spectro analys Learn using	r the upphore ophotosis technical GC-M	ise of a sesis, are cometer iques in the sesis in the sesion in the sesis in the sesis in the sesion in the	PCR, and	DNA ect tox		1,2
I II	Instru Labo prince	tent  Imments used in DNA ratory: Instrumentation iple, working anduse  Imments used in Toxical ratory: Instrumentation iple,working and use	ology on, s.	6 6	Maste electro spectro analys Learn using immun	r the upphore ophotosis technic GC-Manoassa	iques iques stays.	PCR, and res for det PLC, and ic too	DNA ect tox and ols and		1,2
No.	Instru Labo prince Instru Photo	tent uments used in DNA ratory: Instrumentatio iple, working anduse uments used in Toxic ratory: Instrumentatio iple,working and use uments used in Ballis	ology on, s. tics and	Hour 6	Maste electron spectron analysis Learn using immunity Under	r the upphore ophotosis technic GC-Manoassa	iques iques stays.	PCR, and res for det PLC, and ic too	DNA ect tox and ols and		1,2
I II	Instru Labo prince Instru Photo	tent  Imments used in DNA ratory: Instrumentation iple, working and use Imments used in Toxic ratory: Instrumentation iple, working and use Imments used in Ballis ography Laboratory Immentation, principle	ology on, s. tics and	6 6	Maste electron spectron analysis Learn using immunity Under	r the upphore ophotosis technic GC-Manoassa	iques iques stays.	PCR, and res for det PLC, and ic too	DNA ect tox and ols and		1,2
I II	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use Imments used in Toxic ratory: Instrumentation iple, working and use Imments used in Ballis ography Laboratory Immentation, principle	ology on, s. tics and : , working	6 6	Maste electron spectron analysis Learn using immunity Under	r the upphore ophotosis technic GC-M noassa	iques iques iques its, HF	PCR, and res for det PLC, and ic too	DNA ect tox and ols and aethods	S.	1,2
I III	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use  Imments used in Toxic ratory: Instrumentation iple, working and use  Imments used in Ballist ography Laboratory Immentation, principle ises.	ology on, s. tics and : , working	6 6	Maste electro spectro analys Learn using immun Under forens	r the upphore ophotosis technic GC-M noassa	iques to tall ist in the state of the state	PCR, and res for det PLC, and ic too bhy m	DNA ect tox and ols and aethods	S.	1,2
I II	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use  Imments used in Toxic ratory: Instrumentation iple, working and use  Imments used in Ballist ography Laboratory Immentation, principle ises. Imments used in Finger tioned document Lab	ology on, s. tics and : , working rprint and poratory:	6 6	Maste electrons spectrons analysis Learn using immunity Under forens	r the upphore ophotosis technic GC-M noassa	iques to tall ist in the state of the state	PCR, and res for det PLC, and ic too bhy m	DNA ect tox and ols and aethods	S.	1,2
I III	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use  Imments used in Toxical ratory: Instrumentation iple, working and use  Imments used in Ballist iple, working and use Imments used in Ballist iple, working and use Imments used in Fingel Imments used in	ology on, s. tics and : , working rprint and poratory:	6 6	Maste electrons spectrons analysis Learn using immunity Under forens	r the upphore ophotosis technic GC-M noassa	iques to the state of the state	PCR, and res for det PLC, and ic too bhy m	DNA ect tox and ols and aethods	S.	1,2
I III	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use Imments used in Toxic ratory: Instrumentation iple, working and use Imments used in Ballist ography Laboratory Immentation, principle ises. Imments used in Finger tioned document Lab Immentation, principle ises	ology on, s. tics and : , working rprint and ooratory: , working	6 6 6	Maste electrons spectrons analysis Learn using immun. Under forense	r the upphore ophotosis technical ophotosis technical ophotosis technical ophotosis technical ophotosis op	iques iques iques is iques is ballistotographic is for fanalysis	PCR, and are for too det PLC, and too det place too det pl	DNA ect tox and ols and aethods	s.	1,2
I III IV	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use Imments used in Toxical ratory: Instrumentation iple, working and use Imments used in Ballist iple, working and use Imments used in Ballist iple, working and use Imments used in Finger Imments used in Finger Itioned document Lab Immentation, principle Isses Imments used in Serolo Imments used i	ology on, s. tics and : , working rprint and ooratory: , working	6 6 6	Maste electrons spectrons analysis Learn using immunity Under forense.  Exploration documents of the second	r the upphore ophoto is technical ophoto is technical ophoto ic photo ic ph	iques to tographic for finallysis in ELI	PCR, and res for det PLC, and ic too obly many many many many many many many man	DNA ect tox and ols and nethods print a	nd Guges,	1,2 1,2 1,2
I III	Instruction Instru	tent  Imments used in DNA ratory: Instrumentatio iple, working anduse  Imments used in Toxic ratory: Instrumentatio iple,working and use  Imments used in Ballis ography Laboratory Immentation, principle ises. Imments used in Finger tioned document Lab Immentation, principle ises Imments used in Serolo ratory:Instrumentatio	ology on, s. tics and : , working rprint and ooratory: , working	6 6 6	Maste electrons spectrons analysis Learn using immun. Under forense	r the upphore ophoto is technical ophoto is technical ophoto ic photo ic ph	iques to tographic for finallysis in ELI	PCR, and res for det PLC, and ic too obly many many many many many many many man	DNA ect tox and ols and nethods print a	nd Guges,	1,2
I III IV	Instruction Instru	tent  Imments used in DNA ratory: Instrumentation iple, working and use Imments used in Toxical ratory: Instrumentation iple, working and use Imments used in Ballist iple, working and use Imments used in Ballist iple, working and use Imments used in Finger Imments used in Finger Itioned document Lab Immentation, principle Isses Imments used in Serolo Imments used i	ology on, s. tics and : , working rprint and ooratory: , working	6 6 6	Maste electrons spectrons analysis Learn using immunity Under forense.  Exploration documents of the second	r the upphore ophoto is technical ophoto is technical ophoto ic photo ic ph	iques to tographic for finallysis in ELI	PCR, and res for det PLC, and ic too obly many many many many many many many man	DNA ect tox and ols and nethods print a	nd Guges,	1,2 1,2 1,2

	CO PO Mapping						
SN	Course Outcome (CO)	Mapped ProgramOutcome					
1	Understand the instrumentation, principles, and applications of	1, 8					
	tools used in DNA laboratories.	-, 0					
2	Gain comprehensive knowledge of the instruments and	1, 3, 8					
4	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					
5	andIndian investigative agencies.	1, 6					

Course Title Elementary Statistical analysis & Research Methodology									
Course code 23BSFS316R Total credits: 2 L T P S R		C							
Total hours: 30T	0	2							
Pre-requisite Nil Co-requisite Nil  Pre-growning Packelon of Science in Econogic Science									
Programme         Bachelor of Science in Forensic Science           Semester         Fall/ 5th semester of second year of the program									
Course 1. The course aims to enhances the students' a broad understanding of res	earch								
Objectives  1. The course aims to elimances the students a broad understanding of resulting theory of science and qualitative and quantitate		ode in							
research.	ive mem	ous III							
2. The course seeks to enhance the students' skills for developing critical	thinking								
through research literature review in different domain. Consequently it	_								
develop skills for preparation of a research proposal for a master' thesi		/Mini							
research.	1 3								
3. To develop Students competency in planning, conducting, evaluating a	nd presen	nting a							
research project.	-								
CO1 Explain research methodology, evaluate significance of research and id	entify res	search							
problems.									
Explain research design, sampling design and design experiment for research									
CO3 Collection and representation of data and interpret the data with descriptive	e statisti	cs.							
	Explain to write report, article, reviews etc.								
CO5 Explain intellectual property right and related rights									
Unit- Content Contact Learning Outc	ome	KL							
No. Hour									
Research Methodology- An Introduction- Knowledge on	1								
meaning and objectives of research, motivation fundamental conce	-								
	research methodology,								
criteria of good research. Defining the Research including the mean	•								
Problems- definition of research problem, and objectives of research problem	esearcn								
Research Design- meaning and need of research  Able to understa	nd and								
	amental								
	research								
sampling design, Sample Size determination, design, including									
II criteria for selecting a sampling design, different 4 meaning and necessary	~	1,2							
types of sampling design, Experimental Design, research design	5510	-,-							
Principles of Design of Experiment, One – way									
ANOVA, Two- Way ANOVA, CRD, RBD,									
LSD, 22, 23 Factorial Design									
Types of data, sources of data collection, tools  A good knowle	dge on								
of data collection, Nominal, ordinal, interval different types of o	lata and								
and ratio – Attitude scale construction and identify various	sources								
measurement, rating scales, semantic and tools for	data								
III differential (SD), Use of scale in statistical 3 collection		1,2							
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	3	Able to organize and write a comprehensive research report	1,2
	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 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
Practica	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

#### 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). 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				

		SEMESTER	R – V								
<b>Course Titl</b>	e	Ch	emistry-	5							
Course cod	e 23FSCH311R	Total credits: 3	L	T	P	S	R	O/F	C		
		Total hours: 30T + 3	30P 2	0	2	0	0	0	3		
Pre-requisi	te Nil	Co-requisite		•		Nil		•			
Programmo	2	Bachelor of Scie									
Semester		Fall/ 5 th semester of									
Course	_	eparation, properties, ar	nd reactio	ns of n	trogen	-contai	ning o	organic			
Objectives	compounds.										
	· ·	spectroscopy principle		_	_	_					
	· ·	lynamic relationships, c	-					_			
		chemistry, photochemic				_					
CO1		ogical role of essential t gain knowledge abou							1		
COI		gan knowledge abou gen containing organic	•			•					
	named reactions.	gen containing organic	compour	ius suc	n as m	iro anc	ı amın	ies and	men		
CO2		apply the concept of NI	MR in si	male ir	ternret	ation o	f PM	R snect	ra of		
CO2	simple organic me		IVIIX III 51	511415 11	пстргсс	ation	/1 1 1 1 1 1 .	ix speci	14 01		
CO3		iteraction of electromag	netic ligh	t with	matter	and the	e diffe	rent lav	vs of		
	photochemistry as		,								
CO4		Understand the coordination of different metal ions present in the biological systems.									
CO5	Understand the m	olecular techniques ass	ociated w	ith ram	an and	electro	onic sı	ectrosc	сору		
	Understand the molecular techniques associated with raman and electronic specific content   Contact   Learning Outcome										
Unit-No.	Cor	ntent	Contact	:   I	∠earnir	ıg Out	come		KL		
Unit-No.	Con	ntent	Contact Hour		æarnir	ıg Out	come		KL		
Unit-No.	Con Organic Compounds				earnir				KL ——		
Unit-No.	Organic Compounds a) Nitro Compounds	s of Nitrogen		Desc		activit	y of		KL 		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa	s of Nitrogen s alkanes and		Desc	cribe re	activit	y of		KL ——		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic	s of Nitrogen s alkanes and al reactions of		Desc	cribe re	activit	y of		KL		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha	s of Nitrogen s alkanes and al reactions of unism of nucleophilic		Desc	cribe re	activit	y of		KL		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their		Desc	cribe re	activit	y of		KL		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their		Desc	cribe re	activit	y of		KL		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid.	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their		Desc	cribe re	activit	y of		KL		
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their neutral and alkaline		Desc	cribe re	activit	y of		KL		
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of	Hour	Desc	cribe re	activit	y of				
Unit-No.	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro-	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties.		Desc	cribe re	activit	y of		<b>KL</b> 1,2		
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of and tertiary amines.	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their neutral and alkaline e and nomenclature of operties. amines Separation of and tertiary amines. ffecting the basicity	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e of amines. Amine sa	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of and tertiary amines.	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e of amines. Amine sa	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of and tertiary amines. ffecting the basicity alts as phase-transfer tion of alkyl and aryl	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e of amines. Amine sa catalyst and preparate	s of Nitrogen s alkanes and al reactions of unism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of and tertiary amines. ffecting the basicity alts as phase-transfer tion of alkyl and aryl f nitro compounds	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e of amines. Amine sa catalyst and prepara amines (reduction of	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. amines Separation of and tertiary amines. ffecting the basicity alts as phase-transfer tion of alkyl and aryl f nitro compounds we amination of	Hour	Desc	cribe re	activit	y of				
	Organic Compounds a) Nitro Compounds Preparation of nitroa nitroarenes. Chemic nitroalkanes. Mecha substitution in nitroa reactions in acidic, r media, Picric acid. b) Amines Reactivity, structure amines, physical pro Stereochemistry of a a mixture secondary Structural features e of amines. Amine sa catalyst and prepara amines (reduction of and nitriles), reducti aldehydic and keton	s of Nitrogen s alkanes and al reactions of anism of nucleophilic arenes and their neutral and alkaline and nomenclature of operties. Amines Separation of and tertiary amines. Iffecting the basicity alts as phase-transfer tion of alkyl and aryl finitro compounds we amination of ic compounds a reaction, Hoffmann	Hour	Desc	cribe re	activit	y of				

	Spectroscopy II. Nuclear magnetic		Interpret basic NMR	
	Spectroscopy-II: Nuclear magnetic		_	
	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-		equations and concepts.	
	Helmholtz equation, Partial molar			
	properties, Concept of chemical potential,			
	Gibbs-Duhem equation, Variation of			
III	chemical potential with T and P,	6		1,2
	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,			
***	Stark-Einstein law, Jablonski diagram			1.0
IV	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.	6		1,2
	Biological role of alkali and alkaline			
	earth metal ions with special reference to			
	Ca+2, Nitrogen fixation.			
	1. Synthesize nitroalkanes or nitroarenes			
	and study their chemical properties.			
	2. Separate a mixture of secondary and			
	tertiary amines using chemical			
	methods. <b>3.</b> Synthesize primary amines through			
Practical	the Gabriel-phthalimide reaction.	30		1,2,3,4
	<b>4.</b> 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.			

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

SEMESTER – V Course Title Physics- 5										
Course T	itle			Physics-	5					
Course co	ode	23FSPH312R	Total credits: 3	L	T	P	S	R	O/F	C
			Total hours: 30	2	0	2	0	0	0	3
Pre-requi		Nil	Co-requisite			. ~	N	il		
Program			Bachelor of Sci							
Semester			Fall/ 5 th semester of							
Course			clear constituents, l	_						
Objective	es		radioactivity and th	ne princ	ıples	of alp	ha, be	eta, and	d gamma	
		decay.	c· · · · · ·				,•		1	, •
		-	r fission, fusion, ar	_	•			in nuc	clear reac	tions.
		-	iples and operation						<b>C</b> :	
G01			classification of el							
CO1			nstituents and gener				lei, an	d learn	about dif	terent
CO2			d the condition for N				hoto	and as	mme and	thair
		properties.	ent types of radiat	ion suci	ı as	агрпа,	ocia	ana ga	umma amu	uicii
CO3			nt types of nuclear r	eaction a	and ca	alculate	the C	) value	of reaction	n.
CO4			dea of radiation dete							
CO5		Summarize the bas	sic of particle physic	s, types	of pa	rticles a	and co	nserva	tion laws	
Unit-		Conte		Contac					KL	
No.				Hour			`			
	Cons	stituents of nucleus	and their intrinsic		Describe nuclear structure and					
		erties, isotopes and		7	b	inding	energ	у.		
		overy of neutrons, p	_							
I		cons, binding energy								1,2
	-	ergy and its variation with mass number, in features of binding energy versus								
		number curve.	energy versus							
		oactivity, $\alpha$ , $\beta$ , $\gamma$ rac	liation and their		F	xplain	alnha	heta a	and	
		erties, Alpha decay:		5		amma				
	• •	esses, theory of $\alpha$ - e	•				,	1		
II	_	all law, β-decay: en	-							1,2
	β -de	β -decay, positron emission, electron								
	_	are, neutrino hypoth								
		emission & kinema								
		ear fission and fusion	•	•		Inderst				
111		ition for nuclear fus	•	8	h	ısion, a	and ma	ass defe	ect.	1.2
III		nonuclear reaction, ideration in nuclear								1,2
		ct and Q-value of a								
		c idea of nuclear det			(	perate	and ir	iterpret	readings	
		ctors, ionization cha		5		om nu		_	_	
TX7		nter. Basic principle								1.0
IV		ctors and constructi								1,2
	_	o-multiplier tube (P								
	Semi	iconductor Detector	s.							

V	Classification of elementary particles, baryons, leptons, mesons, particles and antiparticles, concept of quark model.  Types of interactions, weak, strong and electromagnetic interactions	5	Classify elementary particles and interaction types.	1,2
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

		SEMESTER	R - V	,						
Course Ti	Biolo	gy- 5								
Course co	de 23FSBO313R	Total credits: 3		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	1		
Programm	ne	Bachelor of Sci								
Semester		Fall/ 5 th semester of								
Course		general plant classification								
Objective		ntification and matching	of wo	oods,	timb	ers, se	eds, a	nd lea	ves for fo	orensic
	purposes.	1.1	1 .		.1 .	c				
		owledge on poisonous p					_			4:
CO1		e importance of wildlife							ie protec	cuon
	0	neral plant classification								
CO2		atch various types of wo					ind lea	ves 10	rensican	у.
CO3		sonous plants and their for the importance of wildlife					1 malar	ant aa	<b>t</b> a	
CO5	*	yielding drugs of abuse					ı reiev	ant ac	ıs.	
Unit-	7 1	ntent		ntact			rning	Oute	ome	KL
No.		ntent		nuact Iour		Lea	········s	Oute	ome	ILL
1100	General plant types a	and their classification			H	istory	tvpes	and p	olicies	
		emes. Sub specialization of forensic				of forest.				
_	botany- plant morph	tany- plant morphology, plant anatomy,								1.0
I	plant systematic, pal	at systematic, palynology, plant ecology,								1,2
	Plant achitecture- ro	at achitecture- roots, stems, flowers,								
	leaves.									
	Types of woods, tim					_	nce, so	_		
	and leaves and their	_				morphology of woody forest				
		atching of various types			and Ecotourism.					
II		eties, seeds and leaves.		6						1,2
	• •	ensic aspects of fiber								
		cent, optical properties, fringence, dye analysis								
	etc.	innigence, dye anarysis								
	Plants of forensic im	portance - Abrus			In	nporta	nce of	tree		
	precatorius, Aconitu	_				•	ogy in		on to	
	occidentale, Argemo				_	restry				
	Calotropis, Cannabis	sativa, Claviceps								
III	purpuria, Cinchona,	Croton tiglium, Atropa		8						1,2
111	belladonna, Erythrox	xylum coco, Gloriosa		0						1,2
		cas, Lathyrus sativus,								
	Manihot utilissima, l									
	Nicotiana tabacum,	Cascabela thevetia,								
	Ricinus communis.									

	Importance of wild life. Protected and		Importance of forest	
	endangered species of animals and plants.		ecosystem, biotic and abiotic	
IV	Sanctuaries and their importance. Relevant	5	Components and forest	1,2
1 4	provision of wild life and environmental act.	3	management and ecotourism.	1,2
	Types of wildlife crimes, different methods			
	of killing and poaching of wildlife animals.			
	Plants yielding drugs of abuse – opium,		Principle of forest pathology	
V	cannabis, coco, tobacco, dhatura, Psilocybin	5	causes of forest diseases and	1,2
	mushrooms.		plant quarantine.	
	1. Morphological study of different types			
	of plants like herbs, shrubs and trees.			
	2. Anatomical study of tissues of stem,			1.2
Practical	root and leaf.	30		1,2, 3,4
	3. Identification and comparison of natural			3,4
	and man-made fibre.			
	4. Identification of Poisonous 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:**

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

		SEMEST	ER – VI									
<b>Course Title</b>			timedia F	orensic								
Course code	23BSFS321R	Total credits: 4	<u> </u>	LT	P	S	R	O/F	C			
<u> </u>		Total hours: 45T-		3 0	2	0	0	0	4			
Pre-requisite	Nil	Co-requisite Bachelor of S			<b>a</b> •	Nil						
Programme												
Semester Course		Winter/ VI Semeste						المسمعة	.1			
Objectives		rledge of imaging an ipheral devices, stor										
Objectives		emote acquisition										
		ormats of forensic in			_							
	3. Analyze regis	stry and logging in	various c	perating	syster	ns, co	nductii	ng in-c	depth			
		of system logs,	kernel log	gs, even	t logs	, and	applic	cation	web			
	servers/proxy	•	1 .		1. 1		. 1	. 1	1.			
	_	s in forensic audio and, acoustic analysis, a	-	_				gitai n	negia			
		processing technique		•		_		omnre	ssion			
		ication, and super re							201011			
CO1	•	es of acquiring digita										
CO2	Apply remote ac	equisition methods	and emplo	y vario	us soft	ware/h	ardwar	e tool	s for			
		equisition and delete										
CO3		nensive registry and						tion of	logs			
~~.		machines and server										
CO4		Utilize forensic audio analysis techniques for audio enhancement, digital media authentication, and automatic speaker recognition in laboratory settings along with their										
	practical aspects.	_	r recognino	on in iao	oratory	seung	gs alon	g with	tneir			
CO5		erpret various audi	o and vide	eo evide	nces fr	om va	rious	multin	nedia			
	_	th their practical asp		00 0 1100								
Unit-No.	Cont		Contact	L	earnin	g Outc	ome		KL			
			Hour				0.75					
	Imaging/acquisition	•		Imagin	-			a				
	Acquisition of stand	•		Recove				m				
1 1 1	peripheral device, of			recover digital evidence from diverse sources, including								
	CCTV, systems (bot		8	stand-alone machines, mobile					1,2			
	logical), Acquisition		devices, and networked						,			
	collection of live sys	-		system	S							
	of mobiles, PDA's, T											
	Navigation systems			A 1			:4: - ·					
	Acquisition over the			~ ~ ~	remote ds and u	•						
	remote acquisition,	-			re/hard							
	various acquisition s		_	forensi					1.2			
	device, details of var		7		leted da	•			1,2			
	enhancement, digita											
	authentication, acou											
	automatic speaker re Registry and Loggin			Condu	ct in-de	nth on	alvoio	of				
	Registry and Loggin and in-depth analysi	-		registry		_	-					
i 1 '	various operating sy	-	operating systems, enhancing investigative capabilities in						1,2			
	analysis mashina an	d conver exectors	10	mvesu	gaar ve c	apaon			-,-			
111	analysis, machine ar	•	10		forensi				-,-			
111   3	analysis, machine ar logs, kernel logs, ev application Web Ser	ent logs, ftp/sftp,	10						-,-			

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	1, 6
2	of sources.  Apply remote acquisition methods and employ various software/hardware tools for forensic image acquisition and	1, 2, 3
	deleted data recovery along with their practical aspects.	
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 Titl			rensic M	edici	ne		ı		1				
Course cod	e 23BSFS322R	Total credits: 4		L	T	P	S	R	O/F	C			
		Total hours: 45T		3	0	2	0	0	0	4			
Pre-requisi		Co-requisit			•	<b>.</b>	Nil						
Programm		Bachelor of S											
Semester		Winter/ VI Semeste							•	11 - 1			
Course Objectives		idents to the fundate ferent types of inc		-		•							
Objectives	declarations.	refent types of inc	quests an	a tile	Totes	01 0	iai ev	idenc	e and	dying			
		nedico-legal aspects	of death.	inclu	ıding t	he dia	gnosi	s. stag	es, and	1 signs			
	_	vell as different type			_	110 010	511051	, sug	,co, am	• 515115			
		wledge on the au				luding	inte	rnal a	and ex	kternal			
		, sample collection											
	suicidal cases	S											
		ents on the types ar											
		tem injuries, and sp											
		tudents with forension			nclud	ing the	estim	ation	of time	e since			
CO1		factors affecting defundamental aspects			foran	cio m	diain	a and	the di	fforont			
COI		s and evidence in leg				SIC III	carcini	anu	the un	Herent			
CO2		edico-legal aspects				the s	tages	and si	igns of	death			
		ses of fatal incidents		2000	,	, 1110			.6				
CO3		gh autopsies, inclu		rnal	and e	xterna	1 exa	minati	ions, s	ample			
		he investigation of s											
CO4	_	sify different types	of injurie	s, dist	tinguis	hing b	etwee	en ante	emorte	m and			
	postmortem inju												
CO5		entomology technique	ues to esti	mate	the ti	ne sin	ce de	ath an	d unde	rstand			
TI 4 NI	the decomposition		Contac		т.	•	- 04			TZT			
Unit-No.	Cont	ent	Hour		Le	arnin	g Out	come		KL			
	Forensic medicine, p	athology, police		De	escribe	e the s	cope (	of fore	ensic				
	inquest, magistrate in				edicin		•						
I	evidence, dying decl	-	8	dit	fferent	tvnes	of in	guests	and	1,2			
_	witnesses, Fundamer				idence			1		1,2			
	scope of forensic me	_											
	Death & its medico 1			Re	ecogni	ze the	sions	and s	tages				
	diagnosis of death, s				death		-		5-0				
	signs of death, ashyx	-			rious				om a				
II	due to Starvation, de		7		edico-					1,2			
	drowning, death due			1110	cuico-	icgai	persp	CHVC	•				
	Anaesthetics deaths.	to electrocution,											
	Autopsy: medico leg	al aspect of dooth		D ₀	rform	auton	ciec c	011004	and				
	internal and external	•			eserve	•			anu				
				_		_							
***	Sample collecting, sa		10		vestiga	_	ecilic i	mearc	0-	1.0			
III	techniques, preserva	-	10	leg	gal cas	ses				1,2			
	Causes of death. Inv	-											
	sexual offences, exh												
	bodies), suicidal case			<u> </u>									
	Injuries: Types an				entify		-	-					
IV	of injuries. Antemor	-	10		stingu	_			ante	1,2			
1,4	mortem injuries. Bite				ortem	and po	ost-mo	ortem		1,2			
	injuries, head injury.			inj	juries								

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	1, 2, 6		
	crime scene management and initial medical response.			
2	Recognize suspects, conduct interrogations, and manage crime	1, 3		
	scenes, including crowd and media control.	1, 0		
3	Discuss effective handling of buried body and suicide cases,	1 2 6		
	emphasizing search methods and psychological assessment	1, 3, 6		
4	Develop skills in conducting autopsies, evaluating injuries, and	1 4 0		
4	examining causes of death in forensic medicine	1, 4, 8		
	Identify, classify, and evaluate injuries, distinguishing between			
5	ante mortem and postmortem injuries and understanding aging	1, 3		
	and artificial aspects along with their practical aspects.			

	SEMESTER – VI										
Course Ti	tle	Chemistry- 6									
Course co	de	23FSCH321R	Total credits: 3	L	T	P	S	R	O/F	С	
			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									
CO1		Understand and gain knowledge about carbohydrates									
CO2		Understand and gain knowledge about protein and nucleic acid									
CO3		Understand the simple and condensed 5/6 membered heterocyclic compounds, their									
004		preparation, characteristics and chemical reactions.									
CO4		Discuss about preparation properties, application and the nature of bonding in metal									
CO5		carbonyl  Identify the different phases of matte and their equilibria from which the stability and									
			sustainability can be predicted.								
Unit-		C	ontent	C	ontact	Le	arning	g Out	come	KL	
No.				]	Hour			_			
	Carl	oohydrates: Class	sification and nomenclature			Cla	Classify and				
	Mono	osaccharides, mech	nanism of osazone			int	interconvert				
	forma	ation, interconvers	ion of glucose and fructose,			car	bohyd	rates a	and		
	chain	lengthening and o			dei	derivatives.					
	Confi	iguration of monos									
	threo	diastereomers. Con		10							
I		ose. Formation of	s.						1,2		
		mination of ring s							1,2		
	•	·	-)-glucose. Mechanism of								
		rotation.									
		tures of ribose and									
		troduction to disac									
		actose) and polysa									
			ving structure determination	•		-					
		· —	es, Proteins and Nucleic				dersta				
		d: Classification, structure and stereochemistry					ucture				
		mino acids. Acid base behaviour, isoelectric				_	pertie				
	_	nt and electrophoresis. Preparation and					ds, pe				
		ctions of α-amino acids.					oteins, cleic a				
		acture and nomenclature of peptides and teins. Classification of proteins. Peptide acture determination, end group analysis, ective hydrolysis of peptides. Classical levels of			8	nu	cieic a	cius.			
п	_									1,2	
		in structure. Protei									
	_	uration.									
			tion, Constituents of nucleic								
			and ribonucleotides. The								
		le helical structure									

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

- 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-	· <b>6</b>						
Course co	de	23FSPH322R	Total credits: 3	L	T	P	S	R	O/F	C
			Total hours: 30T + 30P	2	0	2	0	0	0	3
Pre-requi		Nil	Co-requisite				Nil			
Programm	ne		Bachelor of Science in							
Semester			Fall/ 5 th semester of second							
Course			properties and working med							
Objective	S		tions of two-terminal device							EDs.
		Ÿ .	cteristics and behavior of big							
			fication, working, and applie			_		_	_	1
			fundamentals of analog an	ia aigita	CII	cuits,	Boolea	an aig	ebra,	and
CO1		logic gates	c process in the formation a	nd fobri	ootie	on of I	N iune	otion d	lovico	C
CO2		Summarize the know	-	iiu iabii	all	JII OI I	IN Julic	tion u	ievice	5.
CO3			e integrated circuits such as	On-Ami	າ an	d its a	nnlicat	ions		
CO4			ea of amplifiers and their from				ррпсас	10113.		
CO5		•	of analog and digital circui				es of g	ates		
Unit-			ntent	Contac			ning O		ne	KL
No.				Hour			8 -			
	Sen	niconductor Diodes: F	and N type		]	Explai	n			
	sem	semiconductors, energy level diagram,			5	semico	onducto	or dioc	le	
I	cone	conductivity and mobility, concept of drift			1	behavi	or and	curre	nt	1,2
	velo	velocity, fabrication of PN junction current flow			1	flow				
	mec	hanism in forward ar	nd reverse biased diodes.							
	Two	o-terminal devices an	d their applications: Half-		4	Analyz	ze recti	fiers,		
		re rectifiers, full-wave	_	5	7	Zener	diodes,	, and		
II		rectifiers, ripple factor and rectification efficiency,			]	LEDs	in circu	iits		1,2
		c-filter, Zener diode and voltage regulation,								-,-
	_	rinciple, Principle and structure of LEDs,								
		todiode and Solar Ce			,	[] _m _1 -	stand E	ır		
	_		ors: N-P-N and P-N-P	8			stand E teristic			
III		transistors, I-V characteristics of CC, CB and CE					t gains.			1,2
		configurations, current gains $\alpha$ and $\beta$ and their relations.			`	curren	i gains.			
		plifiers, classification	of class A. B & C		1	Design	and a	nalvze	,	
		Amplifiers. Two stage RC-coupled amplifier and		5		_	ier circ	•		
IV		requency response, ir	• •			•	np app			1,2
	chai	racteristics of an Op-	Amp, Applications of Op-			-				
	Am	ps.								
	Diff	erence between analo	og and digital circuits,		4	Apply	Boolea	an		
		•	s of Boolean algebra,	5		-	a and v	vork w	ith	
		D, OR and NOT gate	_		1	logic g	ates.			
V			AND and NOR gates as							1,2
		-	d XNOR gates, Active							
			concepts of ICs (basic							
	ıdea	only)								

	1. To study the current-voltage characteristics of a		
	P-N junction diode.		
	2. To design and test half-wave and full-wave		
	rectifiers.		
Practical	<b>3.</b> To study the application of a Zener diode as a	30	1,2,
Fractical	voltage regulator.	30	3,4
	<b>4.</b> To study the working principles of LED and		
	Photodiode.		
	5. To analyze the I-V characteristics of NPN and		
	PNP transistors.		

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				

		SEMESTE	R – V	/ <b>I</b>						
Course Ti	itle		Biol	ogy- 6						
Course co	ode 23FSBO323R	<b>Total credits: 3</b>		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 So								
Semester		Fall/ 5 th semester of								
Course		knowledge on importa	nce o	of wild	life, etl	nics an	d man	ageme	ent tacti	cs for
Objective				00						
		e information regarding		tteren	t conse	ervatio	n prog	gramm	e adop	ted in
		conservation of wildlife		matia	n of oo	00****				
CO1	_	nowledge on structure a fferent conservation						odon	tad for	r tha
COI	conservation of		suai	legy	and p	rograi	iiiies	auop	ieu 10.	tile
CO2		ethics and managemen	nt tac	tics fo	r wildl	ife cor	servat	ion		
CO3		icture and function of o			ı wılaı	110 001	1501 7 41	.1011		
CO4		Wildlife Protection Act			its imp	lemen	tation			
CO5		ent conservation prog			_				servati	on of
000	wildlife	ent conservation prog	514111	шаор		mara	101 11		1501 (411	011 01
Unit-	Con	tent	Cor	ntact		Learn	ing O	utcom	ie	KL
No.			Н	our			O			
	Wildlife Importance	Idlife Importance and Conservation-			Stude	nts wi	ll unde	erstanc	d the	
	Definition and impor	efinition and importance of wildlife,			impoi	rtance	of wil	dlife a	nd the	
I		uses of depletion, Important National			need	of thei	r cons	ervatio	on	1,2
		ks, Wildlife sanctuaries and biosphere								
	reserves of India				~ .					
	Environmental Ethics	~				nts wi				
	Conservation and ma	•				and n ildlife	_		tactics	
	Wildlife, In-situ cons	ervation and ex-situ			IOF W	паше	conse	rvatioi	1.	
		nservation novative Methods in Wildlife: Camera								
II	Trap, Conservation D		,	7						1,2
	Sensing, Radio Telen									
	Mobile App, Capturi	•								
	techniques, Trapping	hniques, Trapping, Darting, tagging								
	and banding, Scat and	alysis, Sign surveys								
	Ecosystem: Structure	and Functions, Food			Stude	nts wi	ll knov	w rega	rding	
III	chain, Food web, Po	•	١.,	6		us app			abitat	1,2
		Energy flow in an ecosystem, Ecological				gemen		its		1,2
	Pyramids, Concept of					icance		1 .	• 1	-
	Wild life Protection A	•				nts wi			idea	
137	Wildlife Protection A	· ·		5		PA, 19		u its		1.2
IV	detailed structure, Re WPA 1972 and their			3	шріе	menta	นบก			1,2
	protection and Conse									
	protection and conse	1,441011								1

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>1.Documentation of different invertebrates/vertebrates present in the campus.</li> <li>2.Activity budgeting of any one species.</li> <li>3.Measurements of species diversity from provided data sheet using Shannon Winner Index (H´).</li> <li>4.Measurements of similarity &amp; dissimilarity index of species from provided data sheet.</li> <li>5.Measurements of association index of species from provided data sheet</li> </ol>	30		1,2, 3,4

- **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 Microbiology

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 15th & 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28th July, 2023.

Chairperson, Board of Studies

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 (not more than 100 words)**

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: 140

**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.

**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
Р	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.

### **Breakdown of Credits**

Sl.	Category		<b>Total number of</b>
No			Credits
		Skill Enhancement Course (SEC)	4
		Ability Enhancement Course(AEC)	8
4	University Core	Field Training	
1	(UC)	Discipline Specific Elective (DSE)	
		Value Added Course (VAC)	
		Co and extra-Curricular	4
2	University Elective	Multidisciplinary Course (MDC)	2
2	(UE)	Value Added Course (VAC)	
		Discipline Specific Core (DSC)	84
2	Program Core	Field Training	4
3	(PC)	Research /Industry Internship	7
		Summer Internship	3
4	Program Elective	Discipline Specific Elective (DSE)	16
4	(PE)	Value Added Course (VAC)	4
_	Faculty Core	Skill Enhancement Course (SEC)	4
5	(FC)	Ability Enhancement Course(AEC)	
		Total	140

## **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	124	81.48%
2	Engineering	10	7.41%
3	Commerce and Management	6	11.11%
	Total	140	100%

#### SEMESTER WISE COURSE DISTRIBUTION

				Course		E	nga	agei	ner	ıt		Ma	ximum ]	Marks	for
	S.N.	Course Code	Course Title	Category	L	T	P	S	R	o	C	IA*	SEE*	PE*	Total
	1.	23BSMB111R	Introduction to Microbiology	DSC (Major)	3	0	4	0	0	0	5	40	60	100	200
	2.	23BSMB112R	Microbial Physiology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSMB113R	Biomolecules	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
I	4.	23UBPD111R	Elementary English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester I	7.	23BSMB114R	Field- based Learning and Community Services	Field Training	0	0	0	0	0	8	1	0	0	100	100
	8.	23UBEC111R	Extra-Curricular (Non-CGPA)	VAC	0	0	0	2	0	0	1	0	0	100	100
	9.	23BSCE111R	MOOCS	DSE	0	0	0	0	0	0	1	0	100	0	100
	]	DSC Minor (Sub	Disciplinary) (Anyon	ne to be se	lect	ed)									
	10.	23FSCH101R	Basic Chemistry	DSC (Minor)	2	0	0	0	0	0	2	40	60	0	100
	11.	23FSZO101R	Animal Science	DSC (Minor)	2	0	0	0	0	0	2	40	60	0	100
				Total							20				1100
	Sl.			Course		E	nga	agei	ner	ıt		Ma	ximum ]	Marks	for
	No.	Course Code	Course Title	Category	L	T	P	$\mathbf{S}$	R	o	C	IA*	SEE*	PE*	Total
	1.	23BSMB121R	Bioinstrumentation	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSMB122R	Environmental Microbiology and Microbial Ecology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSMB123R	Enzymes and metabolism	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
r II	4.	2211DDD121D							0	0	2	0	0	100	100
ste	4.	23UBPD121R	Implicative English	AEC	0	0	4	0	0	U	2	0	0	100	
Semester	5.	23UBES101R	Environmental Science	AEC MDC	2	0	0	0	0	0	2	40	60	0	100
Semester			Environmental												100
Semester	5.	23UBES101R	Environmental Science Field- based Learning and Community	MDC Field	2	0	0	0	0	0	2	40	60	0	
Semester	<ul><li>5.</li><li>6.</li></ul>	23UBES101R 23BSMB124R	Environmental Science Field- based Learning and Community Services	MDC Field Training	0	0	0	0	0	0 8	1	40	60	100	100

	Sl.			Course		I	Eng	age	me	nt		Ma	ximum	Mark	s for
	No.	Course Code	Course Title	Category	L	T	P	S	R	o	C	IA*	SEE*	PE*	Total
	1.	23BSMB211R	Immunology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSMB212R	Microbial Genetics	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSMB213R	Agricultural Microbiology and Plant Pathology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	4.	23UBPD212R	English Language for Excellence	AEC	0	0	4	0	0	0	2	0	0	100	100
ш	5.	23BSMB214R	Analytical Biochemistry (Techno Professional Course)	SEC	0	0	2	0	0	0	1	0	0	100	100
Semester III	6.	23BSMB215R	Field- based Learning and Community Services	Field Training	0	0	0	0	0	8	1	0	0	100	100
	7.	22UULS202R	Basic Life Saving Skills	SEC	0	0	2	0	0	0	1	0	0	100	100
	8.	22UUFL202R	Financial literacy Course	SEC	0	0	2	0	0	0	1	0	0	100	100
	9.	23UBCC211R	Co-Curricular (Non-CGPA)	VAC	0	0	0	2	0	0	1	0	0	100	100
	10	23BSCE211R	MOOCs	DSE	0	0	0	0	0	0	1	0	100	0	100
	11.	23BSMB216R	MOOCs open (Generic elective)	DSE	0	0	0	0	0	0	1	0	100	0	100
	D	SC Minor (Sub D	Disciplinary) (Anyone	to be select	ed)										
	14.	23FSZO301R	Entomology	DSC (Minor)	2	0	0	0	0	0	2	40	60	0	100
	15.	23FSBO301R	Forestry	DSC (Minor)	2	0	0	0	0	0	2	40	60	0	100
		Tota	al								23				1500

	Sl.			Course		E	nga	ige	mei	nt		Ma	ximum	Mark	s for
	No.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23BSMB221R	Molecular Biology and RDT	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
K	2.	23BSMB222R	Biophysical Chemistry	DSC (Major)	2	0	0	0	0	0	2	40	60	0	100
Semester	3.	23BSMB223R	Bioinformatics	DSC (Major)	2	0	2	0	0	0	3	40	60	100	200
Sen	4.	23BSMB224R	Food Microbiology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	5.	23UBPD222R	English for Employability	AEC	0	0	4	0	0	0	2	0	0	100	100
	6.	23BSMB225R	Microbial Culture Techniques (Techno professional Course)		0	0	2	0	0	0	1	0	0	100	100

	7.	23BSMB226R	Field- based Learning and Community Services I	Field Training	0	0	0	0	0	8	1	0	0	100	100
	8.	23UULS202R	Basic Acclimatizing Skill	SEC	0	0	2	0	0	0	1	0	0	100	100
I	9.	23BSMB227R	MOOCs open (Generic elective)	DSE	0	0	0	0	0	0	2	0	0	100	100
Semester	10.	23BSCE221R	Indian Heritage (MOOCs)	DSE	0	0	0	0	0	0	1	0	100	0	100
e II	11.	23UCDL101R	Digital Literacy	SEC	0	0	2	0	0	0	1	0	0	100	100
	12.	23UBEC221R	Extra-Curricular	VAC	0	0	0	2	0	0	1	0	0	100	100
	DSC	Minor (Sub Disc	iplinary) (Anyone to l	oe selected)											
	15.	23FSFD401R	Basics of food Science	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	16.			DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
			Total:								26			_	1600

	Sl.	Course Code	Course Title	Course			Eng	age	eme	nt		Max	imum N	<b>Aarks</b>	for
	No.	Course Coue	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23BSMB311R	Medical Bacteriology and Virology	DSC (Major)	3	0	4	0	0	0	5	40	60	100	200
	2.	23BSMB312R	Medical Mycology and Parasitology	DSC (Major)	2	0	2	0	0	0	3	40	60	100	200
	3.	23BSMB313R	MOOCs open (Generic elective)	DSE	0	0	0	0	0	0	2	0	0	100	100
	4.	23BSMB314R	Bio fertilizer Production (Techno professional course)	SEC	0	0	2	0	0	0	1	0	0	100	100
	5.	23BSMB315R	Summer Internship	Summer Internship	0	0	0	0	0	24	3	0	0	100	100
ter V	6.	23BSMB316R	Research 1 (Review of literature)	Research	0	0	0	0	8	0	2	0	0	100	100
Semester V	7.	23BSMB317R	Research methodology/ statistical analysis	DSC (Major)	2	0	0	0	0	0	2	50	50	0	100
	8.	23BSCE311R	MOOCs	DSE	0	0	0	0	0	0	1	0	100	0	100
	9.	23BSMB318R	MOOCs open (Generic elective)	DSE	0	0	0	0	0	0	2	0	0	100	100
	10.	23BSMB319R	The Age of Sustainable Development (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
	DSC	C Minor (Sub Dis	ciplinary) (Anyone to	be selected	)										
	11.	23FSZO501R	Wild life conservation and Management	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	12.	23FSFS501R	Toxicology	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
			Total								26				1300

	Sl.			Course		]	Eng	age	mer	ıt		Max	imum	Mark	s for
	No.	Course Code	Course Title	Category	L	T	P	S	R	o	C	IA*	SEE*	PE*	Total
	1.	23BSMB321R	Fermentation Technology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSMB322R	Industrial and Pharmaceutical Microbiology	DSC (Major)	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSMB323R	Mushroom cultivation (Techno professional skill course)	SEC	0	0	2	0	0	0	1	0	0	100	100
VI	5.	23BSMB324R	Research Project-2 (Dissertation)	Research	0	0	0	0	20	0	5	0	0	100	100
ster	6.	23BSCE321R	MOOCs	DSE	0	0	0	0	0	0	2	0	100	0	100
Semester VI	7.	23BSMB325R	MOOCs open (Generic elective)	DSE	0	0	0	0	0	0	2	0	0	100	100
	8.	23BSMB326R	AI in Healthcare Specialization (coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
		DSC Minor (Sub	Disciplinary) (Any tw	o to be sele	ected	l)									
	9.	23FSBO601R	Herbal Medicine	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	10.	23FSFD601R	Community Nutrition	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	11.	23FSCH601R	Natural Product Chemistry	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
		То	tal								26				1100

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

		SEMESTER – I  Introduction to Microbiology											
Cours	se Title		Introduct	ion to M	Iicrol	piolog	<b>y</b>						
Cours	se Code	23BSMB111R	Total credits: 5 Total hours: 45T-	<b>-60P</b>	1 3	T 0	P 4	S 0	R	0/F 0	<b>C</b> 5		
Pre-re	equisite	Nil	Co-requisit			1 0		 Ni		U	] 3		
	amme	- \	Bachelor of S		n Mia	robio	ology						
Semes			Fall/ I semester of										
	ourse jectives	microbiology a 2. To teach the stu 3. The course pro-	of this paper is to fand diversity of micro udents about the diffivides insights concertaining of microorga	amiliarize oorganis erent sta rning asp	e the ms.	stude:	nts w	of m	e basi	ganisn	ns.		
(	C <b>O</b> 1	Describe the mic development of m	robial classification icrobiology.	n and co	ontrib	utions	s of	key	micro	biologi	ists in		
	CO2		acteristic of bacteria						oitats				
	CO3	_		ia and the concepts of sterilization.									
	CO4	* * *		robial compounds and their production.									
Unit	CO5	Explain the mecha	inism of antimicrobi	Contac		and t	neir j						
No.		Content		Hour		Lea	rnin	g Out	come	:	KL		
	Spallanz Edward Microbi Microb kingdon Morpho Bacteria	of microbiology: Ozani, Pasteur, Joseph Jenner and Fleming ology; ial Classification: to a and five kingdom logy of bacteria, Ult I cell, Nutritional ty asis of oxygen requi	Lister, Koch, ; Scopes of wo kingdom, three classification; crastructure of pes, classification	morphology, cell structure and nutrition of bacteria.							1,2		
II	Thermo psychro halophil General lytic and	es in different environments, hyperthermo philes, acidophiles, es, Barophiles, Methoda characteristics and all lysogenic cycle. Und fungal cells.	philes, alkaliphiles, hanogens structure of virus,	Describe, illustrate an explain different type extremophiles. Understand the structuand replication of bacteriophage.							1,2		
III	Methods types - I of pheno	media and types: Consept of Sterili Physical and chemic of coefficient of disi	zation - definition, al, Determination nfectant.	7	ex of Pr m di ste	kplain f cultureservaicroom fferen eriliza	the or ration rgani nt me	edia a Meth sms a thods	ent typ nd nods o nd the of	f	1,2		
IV	auxochr of staini	nd Staining Techniq ome, chromophores ng - Gram, Acid Far and Endospore.	and dyes. Types	7	ex	kplain	the o	ustrat liffere mique	ent		1,2		
V		ics and types: Antibganisms, Antifungal	_	3	di	escrib fferen	ıt typ	_	ain th	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			
Practical	use of spectrophotometer.			
acti	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.			

- 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

			SEMESTE	R – I								
Cours	se Title		Mic	robial Phy	siology				_			
Cours	se Code	23BSMB112R	Total credits: 4	. 24D	L	T	P	S	R	O/F	C	
Dro r	equisite	Nil	Total hours: 45T		3	0	2	0 N	0	0	4	
	ramme	INII	Bachelor of S		// ///////////////////////////////////	ngv		11	11			
Seme			Fall/ I semester of					e				
	ourse lectives	1.To build a stropathways 2.To teach the carbohydrates.	ng foundation in the concept of transported transported to the molecular adaptates	he dynamiortation of	cs and b	ioen	erge	tics				
	C <b>O</b> 1		encing bacterial gro			nt o	f bac	teria	l grov	wth.		
C	CO2		vement of biomole								sing	
(	CO3	Describe different	aerobic and anaerob	oic carbohy	drate meta	abol	ism a	and p	athw	ays		
	CO4		ples and pathways o							-		
(	CO5	Describe microbial	nitrogen fixation a	nd adaptation	on.							
Unit		Content		Contact Learning Outcome								
No. I	3.6: 1:	al Growth and Nutrit	·	Hour 10	Describ		1	1 .	.1		,2	
	Growth: phases o factors o growth r growth ( growth.) Microsco count, M Counting Turbidity spectrop (definitio Microbia macro ar organism Membra organiza of cellula active, g protein t liposome	Definition of growth f growth, Influence on growth, generation ate. Synchronous grochemostat and turbid Measurement of Groppic count - Haemod lembrane filtration; I g method; Measurements- Nethotometer technique on of terms) al Nutrition: Microbin d micronutrients, class based on nutrition ne Transport: Structution of biological mear transport - passiver oup translocation, nor ansport system, carries, ion channels, Nature of the growth of the structure of the system of the system of the system of the system, carries, ion channels, Nature of the system of t	n, Growth curve, of environmental a time and specific owth, Continuous dostat), Diauxic wth: Direct ytometer; Viable Electronic Coulter ent of cell mass; phelometer and s. Growth Yield al nutrients, assification of al requirements. are and embranes, Types , facilitated, nembrane bound rier models, - K+ -ATPase.		mode of and nutrinfluence factors of	micrition micro	erobi n and diffi neir g	al gr l erent growt	owth th			
II	diffusion channels driven tr uniport), Phospho Iron (Gra Moveme	ent of biomolecules: a, aquaporins, mecha b, ABC transporters, ansport (symport, an Group translocation transferase system (lam +Ve and Gram -Vernt of whole cell: Chand regulation of biomatical processes of the control of the contr	nosensitive/ion- Chemiosmotic tiport and / PTS), transport of Ve bacteria). emotaxis, Quorum	8	Describ explain biomole diffusio driven t phospho	mov cule n, cl rans	es the es the nemi port,	nt of ough	n otic		,2	

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

- 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							
Course Title Bio-Molecules											
Cour	se Code	23BSMB113R	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		•	•
Progr	ramme		Bachelor of S	cience	in M	[icrobio]	logy				
Seme	ster		Fall/ I semester of	first ye	ar of	f the Pro	ogran	nme			
	ourse ectives	<ul><li>2. Comprehend</li><li>3. Analyze the c</li></ul>	<ol> <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</li> </ol>								
(	CO1	Describe the struc	eture, functions and ty	ypes of	DNA	A and R	NA				
(	CO2	Outline the proper	rties of essential and	non-es	sentia	al amino	acid.				
(	CO3	Describe various	structure of proteins	and cla	ssific	cation.					
(	CO4		of carbohydrate in to alitative tests in their			tructure	, class	ificat	ion, p	roperti	es and
	CO5	Identify and categ	orize lipids and their	deriva	tives	•					
Unit No.		Content	t		Contact Hour Learning Outcom			Learning Outcome			KL
I	ribose, nucleo bondin letter c forms denatu	c acid: Structure (N deoxyribose, Nucle tides); glycoside and g, polynucleotide (f ode), DNA (Watson [A, B, Z]; Physical I ration and renaturati Clover leaf model o	osides, I phosphodiester ormation, single I-Crick Model; Properties; on); RNA and its	10		Describ explain function includin forms.	the st	tructu ucleic	re and		1,2
II	Non- E	acids: Classification Essential amino acidental, chemical & option	s; Properties	5		Describe explain propert and class	the st	tructu amin	re and		1,2
III	Protein: Classification based on (shape [fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin), lipoproteins, metallo proteins, glycoprotein and nucleoproteins]; chemical composition); Structure (primary, secondary, tertiary & quaternary); Denaturation and renaturation; Functions.			10		Describ explain function	the st	ructu	re and	d	1,2
IV	and Larotation Disacce proper (occurre function types,	nydrates: Classificate forms); Anomers, Epn; Monosaccharides harides (structure, o ties and functions); (rence, structure, propons); Heteropolysacc composition and functions)	commers, Muta- (linear and cyclic). ccurrence, Cellulose perties and chrides (occurrence,	10		Describ explain function	the st	ructu	re and		1,2

V	Lipids: fatty acids; glycerol; sphingosine;	10	Describe, illustrate and	1,2
	classifications; and characterization;		explain the structure and	
	Saponification and iodine number; Properties		function of lipids.	
	(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.			
	Qualitative analysis of Carbohydrate	30	Describe, illustrate and	1,2,3,4
	Fehling's Test		explain apply qualitative	
	Barfoed's Test		analysis of carbohydrate,	
	Molisch's Test		protein and amino acids.	
l E	Benedict's test			
Practical	Qualitative analysis of proteins			
Lac	Biuret Test			
Pı	Xanthoproteic Test			
	Precipitation test			
	Heat and Acetic acid test			
	Qualitative analysis of amino acids			
	Ninhydrin Test			

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	Animal Science										
Cou	rse code	23FSZO101R	Total cre	edits: 2 urs: 30T	1. 2		P 0	S 0	R	O/ 0		<u>C</u>
Pre-	requisite	Nil		-requisite				N		1 -		
Prog	gramme		Bachelo	or of Scienc	e in Mi	crobio	ology	7				
Sem	ester	Fal	l/ I semes	ter of first	year of	the Pı	rogra	amme	e			
(	Course Objectives	<ol> <li>Analyze the diversity, structure, and classification of the animal kingdom, focusing on triploblastic coelomate organization.</li> <li>Understand life processes including osmoregulation, excretion, neural conduction, endocrine regulation, and reproduction.</li> <li>Examine the relationships between insects and microbes, and explore integrated pest management strategies.</li> <li>Explore the principles of evolution, biodiversity, and genetics, including Mendelian and non-Mendelian inheritance patterns.</li> </ol>						ural ore				
	CO1	Identify and classif	y species o	of animal ki	ngdom.							
	CO2	Explain various bio		•								
	CO3	Explain and illustra										
	CO4	Illustrate the evolut	ion proces	s, importan	ce of bio	odiver	sity l	notsp	ot			
	CO5	Describe classical genetics of living organism					T					
Unit No.		Content		Contact Hour	Lo	earnii	ıg O	utcor	ne		K	L
I	No.			5	Descri explain associa of the and in Identif place i perform accord habitat	n the batted we body in the land the land the land the land to land the lan	pasic with earn ver rates cture body funct the h	conceach systemates that systemates that systemates and the constant of the co	epts yster ites are ems t	in	1	,2
II	Reptilia, Class Aves, Class Mammalia  Life processes Concepts of osmoregulation and excretion, Categorization of animals on the basis of principle nitrogenous excretory products. Ornithine cycle, formation of urea, determination and detoxification. Control and Coordination, Irritability, Structure of neuron, sense organs - human eye and ear. Conduction of nerve impulse: Resting potential, action potential and refractory period. Synaptic transmission, Endocrine regulation: Hormones as chemical messengers, feedback mechanisms. Reproduction: Gametogenesis, structures of egg and sperm of mammal. Fertilization and in			6	Descri explain differe endocr reprod animal	n the k nt life ine re uctive	now proc gulat	ledge essestion a	of s, nd		1	,2

III	vitro fertilization, oviparity, viviparity and ovo-viviparity.  Insect microbiology: Mutualistic associations between insects and microbes	5	Describe, illustrate and explain different types of	1,2
	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		associations of insects, insect behaviour and role of insect as a vector of various diseases.	
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, 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.	7	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							
Course Title Basic Chemi					istry							
Course code		22EC(1101D	Total C	Total Credits: 2			T	P	S	R	O/F	C
		23FSCH101R	Total H	ours: 30T		2	0	0	0	0	0	2
Pre-re	equisite	Nil	Co	o-requisite					Ni	il		
Progr	amme		Bache	elor of Scie	nce in I	Mic	robi	ology	7			
Semes	ster	Fa	all/ I seme	ester of firs	st year	of tl	he P	rogra	amme			
_	Course ojectives	2. To give a detailed	2. To give a detailed description of atomic structure, different theories related to it and the knowledge of classical and quantum chemistry.									
	CO1	Identify the order temperature depend	dency of r	reaction rate	es using	g the	Arrl	neniu	s equa	ation.		
	CO2	Describe concepts buffers and solubil		trochemistr	ry, elec	troc	hemi	ical	cells,	acids	s/base,	pH,
ı	CO3	Describe and analy mechanics and Sch				oerg	Unc	ertaiı	nty pri	ncipl	e, Quar	ntum
	CO4	Describe concepts of chemical bonding, periodic properties.										
	CO5	Describe the different types of organic reactions along with their mechanisms. Organic molecules and their stereochemistry.										
Unit No.		Content		Contact Hour		Le	arni	ng O	utcon	ne		KL
I				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 through Arrhenius equation.					d the tion.	1,2	
II	conductance, Faraday's Law of electrolysis, Electrolytes, Lewis's theory, Arrhenius theory for dissociation of electrolytes, ionization constants of weak acids and bases, pH, buffers, solubility products, salt effects			6	Descrithe un	ribe, nder roch acid	, illus lying emis ds/ba	strate g con try, e	and ecepts electro	xplain of chem	ical	1,2
Ш	and Solubility  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			5	the at Uncer mech equat graph differ	tomi rtair anical ical rent lectr	c structs and To I represented to the structure of the st	uctur rincip d Sch earn esent ic or	and e e, Hei ble, Quaroding about ation bital a lled in	senbe uantur ger w the of and ho	erg m ave	1,2

	orbitals. (Only graphical representation) Rules for filling electrons in various orbitals, electronic 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, 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	ER – I								
Cours	se Title		Eler	nentary E	nglish							
Cours	se code	23UBPD111R	<b>Total Credits:</b>		L	T	P	S	R	O/F	_	
			Total Hours:		0	0	2	0	0	0	2	
Pre-re	equisite	Nil	Co-requ	isite 				Nil				
Progr	ramme		Bachelor (	of Science i	in Microl	biolo	ogy					
Semes	ster		Fall/ I semester of first year of the Programme									
	Course ojectives	and construct 2. To master ad construct varie 3. To develop sp pronunciation 4. To improve communication barriers to effect. 5. To enhance positions	dents to identify affirmative and a lyanced gramma ous types of sent beaking skills: En , intonation, and communication process, types ective communic resentation skills tion and effective	negative sear concepts ences, and nable stude stress, and n skills: , formal and cation. s: Enable st	ntences. Enable understar nts to intr effective Enable d informa	stud nd de rodu ly as stud il co	dent egre ce th sk an ents mm	s to es of nems nd of to unica	use com- selves fer in und ation,	detern pariso , use of forma erstan and io	niners, n. correct tion. d the dentify	
Equip students to recognize and apply parts of speech, articles, and auxiliary and to create both affirmative and negative sentences.							verbs,					
	CO2	Teach students to comprehend degree			m differ	ent	type	es of	f ser	ntence	s, and	
	CO3	Prepare students intonation, and str								onunc	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 aids proficiently.	key component	s of an effe	ctive pres	senta	ation	and	how	to use	visual	
Unit No.		Content		Contact Hour				utco			KL	
I	i. Parts of ii. Articles iii. Auxilia	S		6	fundam	Students will demor fundamental underst of grammar rules.					1,2, 3	
II	i. Determi ii. Sentend iii. Types Impera	ammar (Flipped classroom) Determiners Sentence Construction Types of Sentences (Assertive, Imperative, etc.) Degree of Comparison			Student gramma varied s	ıtica	lly c	orrec	ct and		,2, 3,4	
III	ii. Pronun	Skills etion and Greetings ciation, Intonation, and offering inforn		5	Student introducengage converse pronunce	ce th in ba ation	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	23UBEC111R	Total credits: 1		L	T	P	S	R	O/F	C	
			Total hours: 60		0	0	0	4   Ni	1	0	1	
	quisite	Nil	Co-requi		: L	• - 1		INI	1			
Progra		Bachelor of Science in Microbiology										
Semes	ter	Fall/ I semester of first year of the Programme										
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> </ol>										
C	01	Enhance Leadership Sl activities.	xills-Students wi	ll develop	leade	rship	abi	lities	throu	ıgh va	arious	
CO	02	Improve Social Interaction others.	ion-Students wil	ll learn to i	intera	ct an	d bu	ild re	elatio	nships	with	
CO	03	Develop Personal Inte personal interests and h		ies- Studer	nts w	ill e	xplo	re an	d de	velop	their	
CO	04	Strengthen Problem-Sol creatively and effective	-	ents will in	nprov	e the	ir ab	ility to	o solv	ve prol	olems	
CO	<b>O</b> 5	Foster Cultural Awaren of different cultures.	ess- Students wi	ll gain a be	etter u	ındeı	stan	ding	and a	pprec	iation	
Unit No.		Content		Contact Hour	]	Lear	ning	Out	come	;	KL	
I	particic currice Unive Swims Tennis games Drama encou activit interes profes organi	on the learner's interest apate in various sports, mular activities joining the risity (Football, Futsal; Criming; Basketball; Badmins; athletics and other outder; Dance; Music; Vocals; a; Literary activities); The raged to participate in regies, workshops, competitest and hobbies; Renowned sionals/ personalities are using workshops to promodulents.	usic, and co- clubs of the ricket; nton; Table oor and indoor Photography; e students are gular club ions as per their d skilled invited	60	spor curr thro stud physi- lead crea The man kno wor prof self- fost The cult incli lear stud inter skill pass	tts, nricular ugh lents sical dershittivity will ager wheel kshoo cession confidents are according to the confidents are accor	nusicum acumiv will and ip, to y ll en ment ge the ps wonals identity, a enc to p, devoid cu that	ing	co- s offer club lop al agi ork, a  time prace h nown build nile grow omot , elong ing their new e nd	ered s, sility, and stical ned l	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

	SEMESTER – II											
Cour	se Title			Bioinstr	umenta	tion						
Cour	se code	23BSMB121R	Total credit		L 3	T 0	P 2	S 0	R	O/I 0	F	<b>C 4</b>
Pre-r	equisite	Nil		quisite	3	U		Ni				-
	ramme		l.	r of Science	e in Mic	robio	logy					
Seme		Sp	ring/ II seme					ramn	ne			
	ourse ectives	1. Explain the pri	nciples, types, he history, y. the principle	, and applic classificat es and ap	ations of	variond s	ous n sepai	nicros ration entrifu	tec tec	hnique n an	es d	es. in gel
(	CO1	Describe the differ	ent microscop	y principles	and tecl	hniqu	es.					
(	CO2	Develop proficienc	y in different	chromatogr	aphic tec	chniq	ues.					
(	CO3	Explore different a	nalytical centi	rifugation a	nd their a	applic	atio	ıs.				
(	CO4	Explore different a	nalytical centr	rifugation a	nd their a	applic	atio	ıs.				
(	CO5	Interpret the principal	ples and appli	cations of s	_							
Unit No.		Content	Contact Hour	L	earni	ing (	Outco	me		K	L	
I	Microscopy: types of microscopes and their principle, resolving power, numerical aperture			10	Describ the app types o	licati f mic	ons o	of diff opes	erent			,2
П	Classific Choice Column column chromat	tography: Introductication, Separation teof method. Chromatography: Achromatography, Patography. Thin layer tography, Paper chromange chromatography	chniques,  Adsorption rtition  matography,	10	Describ the con and its princip separat from a	cept of types le that ion of	of ch with t ena f a bi	romat its w bles omole	ograp orkin	ohy g	1,	,2
Ш	rotors, A	gation: Introduction Application of densit lytical centrifugation Centrifugation and ion	y gradient a. Different	7	Describ the func- the cen along w and app	dame trifug vith it	ntal l ations s dif	knowl tech	edge nique	of	1,	,2
IV	Gel Electrophoresis: Introduction, principle, types, application, Blotting technique: Southern blot, Western Blot and Northern blot			10	Describ the theo the gel techniq workin applica learning blotting	oretic electi ue hi g prir tion. g abo	al kn copho ghlig nciplo Also ut the	owled oretic thting and enable e diffe	lge of its le		1,	,2
V	applicat electrop Spectro	phoresis – principle a ion - agarose gel phoresis, SDS PAGE scopic techniques: In e and application of scopy		8	Describe the technology electron working applica	nnique phore scopy g prir	e of sis and in the control of the c	nd erms (		ain	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						

	SEMESTER – II										
Cour	se Title	Environmenta	d Microbio	logy ar	nd M	icro	bial l	Ecolo	ogy		
Cour	se code	23BSMB122R Total credits		I		P	_	R	0/	_	C
		Total hours:		3	0	2		0 Nil	0		4
	equisite ramme	Nii Co-re Bachelor of	equisite Science in	Micro	hiala	ON/		NII			
Seme		Spring/ II semester					mm	ρ			
		Understand the role of microorgan							σe		
	ourse jectives	<ol> <li>Chaerstand the role of incroorgal</li> <li>Recognize microorganisms as independent of the role of incroorganisms.</li> <li>Understand microbial processes at the role of incroorganisms.</li> </ol>	icators of al	lteration	of a	n ec	osyst	em.	_		
(	CO1	Enumerate the microbial diversity an	d their extr	eme hal	oitat.						
C	CO2	Illustrate the occurrence and distribu	tion of mici	roorgan	ism iı	n the	e aqua	atic e	nviro	onn	nent.
C	CO3	Describe the role of microorganisms	in nitrogen	fixatio	n and	the	gene	s invo	olvec	1.	
C	CO4	Explain the role of microorganism Bioremediation.	n in degrad	dation	of en	viro	nmei	ntal	pollu	ıtan	t and
C	CO5	Describe the different types of micro	bial interac	tions an	d bio	geo	chem	ical c	cycle	s.	
Unit No.		Content	Contact Hour	L	Learning Outcome					KL	
	ecologic fluctuat pyramic and thei Diversit commun Microbe thermop acidoph of decor	and biotic factors in an ecosystem, cal niche, concept of community, ion and succession. Ecological d, energy flow, food chain, food webs ar dynamism, stability. The state of microbes: Microbial nities in terrestrial and aquatic, es in extreme environments — ohiles, psychrophiles, barophiles, iles, alkaliphiles and halophiles, Role mposers, Microbiology of air, ation of air microflora.		explain the interaction between the microbes and other organisms in an ecosystem and the diversity of microorganisms in the environment							
II	Aquatic environ condition Distribu aquatic environ environ water, v for hum microbi Wastew indicato	Microbiology: The aquatic ment - major environmental ons influencing microflora. In action of microorganisms in the environments - freshwater ment, estuaries and marine ment. Microbiology of drinking water pollution, purification of water and consumption. Assessment of all status in water and waste water. Frater characteristics, Bacterial ors —	10	Describe, illustrate and explain the Aquatic environment and the microorganisms presenthe water bodies and to understand the microbiand purification of drinwater.					ogy		1,2
III	DO, BOD, COD.  Soil Microbiology: Soil microbes and soil fertility, Nitrogen fixation: Biochemistry of Nitrogen fixation - mechanism of nitrogenase - hydrogenase - Assay of nitrogen fixation - physiology of legume root nodule, leghaemoglobin - Synthesis, Genes involved in nitrogen fixation  To Describe, illustra explain the micro in the soil and th nitrogen fixation soil fertility.					robes heir i	s pres	n		1,2	

IV	Bioremediation — Factors affecting the bioremediation process, Bioremediation of toxic waste sites; Bioremediation practices and technologies; Bioleaching of copper - Role of microbes; Microbial degradation of environmental pollutants- industrial solvents, pesticides, petroleum hydrocarbons, xenobiotics; Biodeterioration — paper, textile, wood, metal, Corrosion	8	Describe, illustrate and explain the types of microbial interaction with other organisms and the role of microbe in the biogeochemical cycles	1,2
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												
Cours	se Title			es and Me				1		1		
Cours	se Code	23BSMB123R	Total Credits: Total Hours:			$\begin{array}{c c} L & T \\ \hline 3 & 0 \end{array}$	P 2	<b>S 0</b>	R 0	0/F 0	<b>C</b> 4	
Pre-re	equisite	Nil	Co-1	requisite				Ni	il			
Progr	amme		Bachelor of S	Science in I	Microbiol	ogy						
Semes	ster	Sprin	g/ II semester (	of first yea	r of the P	rogra	mme	e				
	ourse ectives	applications.  2. Describe the types,  3. Analyze carbohyd regulatory mechani  4. Explain the roles of	<ul><li>applications.</li><li>Describe the types, functions, and deficiency disorders of vitamins and minerals.</li><li>Analyze carbohydrate and protein metabolism, including key pathways and regulatory mechanisms.</li></ul>									
C	CO1	Describe enzymes, enzy	me kinetics, in	cluding car	bohydrate	s, and	prot	eins	met	tabolis	sm.	
C	O2	Explain the physiologic growth and developmen			nerals and	their c	contr	ibuti	on f	or ove	rall	
C	03	Describe the generatio regulation.	n of cellular e	nergy throu	ıgh carbol	nydrat	te m	etabo	olist	n and	its	
С	O4	Illustrate the interconnassociated metabolic pa		protein n	netabolism	in o	ur bo	ody	and	differ	rent	
C	<b>O</b> 5	Analyze the physiologic	cal effects of gr	owth regul	ators in pla	ant gro	owth	and	dev	elopm	nent	
Unit No.		Content		Contact Hour	Lear	ning	Outo	come	e	K	L	
I	Charac Coenzy mechan Induce (Micha	te: History, Terminology, teristics Classification, nayme; cofactor; active site nism action (Lock & key d fit model), Enzyme Kintelis - Menten equation, I lot), Enzyme (inhibition, ation).	omenclature; ; ribozyme; model; netics Line weaver	13	Describe, illustrate and explain and enzyme kinetics.						,2	
II	Vitami	ns and Minerals: Definitions; classification; source		10	Describe explain t and func and mine	he typ	es, s	ourc	es	1.	,2	
III	oxidati metabo pentoso pathwa	Carbohydrate metabolism: Glycolysis, oxidation of pyruvate, TCA cycle, metabolism of glycogen, gluconeogenesis, pentose phosphate pathway, glycosylates pathway, Mitochondrial electron transport, oxidative phosphorylation, inhibitors.			Describe explain to carbohyd and the e	he pat Irate r	hwa netal	y for oolis	r m	1.	,2	
IV	Protein Oxidat decarb	Metabolism- Degradation ive, non-oxidative deamit oxylation of amino acids eatinine formation.	on of proteins, nation and	8	Describe explain t protein n enzymes	he pat netabo	hwa olism	y for	r		,2	
V	Plant g Gibber	rowth regulators - Auxin rellins, Cytokinin's. Abso ne. Photosynthesis- Struc	isic acid and	7	Describe explain to regulator	, illus he pla	trate int gi	owt		1,	,2	

	photosynthetic apparatus, C3 and C4 pathways, Light and Dark reaction, Nitrogen metabolism and fixation of nitrogen in leguminous plants.		functions, and also explain and illustrate CO2 and N2 fixation.	
Practical	<ul> <li>A. Quantitative estimation of</li> <li>1. Proteins (Lowry's method).</li> <li>2. DNA (Diphenylamine method),</li> <li>3. RNA (Orcinol method),</li> <li>4. Amino acids (Ninhydrin reaction),</li> <li>5. Sugars (Dinitrosalicylic acid method).</li> <li>B. Extraction of Protein from milk,</li> </ul>	30	Describe, illustrate and explain estimate the sugars, proteins, DNA, RNA and amino acids of given sample and extract protein from milk.	1,2,3,4

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					

		SEMESTER – II															
Cours	se Title		Environm	ental Stud	lies												
Cours	se code	23UBES101R	Total Cred Total Hou			L 2	T 0	P 0	S 0	R	O/F 0	7 <u>C</u>					
Pre-re	equisite	Nil		-requisite		_	, ,		Nil	, v							
	amme		Bachelor o	_	n Micro	biol	ogy										
Seme			/ II semeste					mm	ρ								
Schie	<b>3</b> (C)	1. To prepare students for								ina	comr	lov					
		environmental issues					-			_	comp	лех					
Co	ourse	2. To develop a world po	_			-	•		_		ironm	nent					
	ectives	and its associated	-														
	cenves	motivations and com						_									
		of current problems a			-			, ,									
		3. To gain knowledge ab	-			ersity	and	its in	porta	ance.							
	CO1	The students will be abl	e to apprec	iate the eth	ical, cros	ss-cu	ltural	, and	histo	orica	l con	text					
	.01	of environmental issues															
C	<b>O2</b>	Students will learn abou			importan	ice ai	nd en	viron	ment	al in	npact	s of					
		Human activities on nat Gain knowledge about			etam St	udan	te wi	11 ha	ahla 1	to un	doret	and					
C	O3	the concept of biodivers			stem, st	uucii	.ts w1.	II UC	aoic i	io un	ucist	ana					
C	O4	Gain knowledge about t			diversity	and	its in	nport	ance								
C	O5	Aware students about p	roblems of	environme	ental pol	lutio	n, its	imp	act o	n hu	man	and					
	U3	ecosystem and control r	neasures.	1	1												
Unit		Content		Contact	L	earn	ing (	Outc	ome		K	KL					
No.	Multid	isciplinary nature of		Hour 4	Enviro	nmer	ntal si	tudie	<u> </u>		1	1,2					
_		<b>mental studies:</b> Definition	on, scope	_	combin					e	1	,2					
		portance, Need for public	, 1		enviror	nmen	tal is	sues.	Its								
	awaren	ess.			multidi	•	•			is							
					key to												
					probler and edu					S							
					promot												
II	Natura	l Resources: Renewable	and non-	6	Natura				_		1	1,2					
		<b>ible resources,</b> Natural res			renewa					ble,							
		ociated problems. Forest r			face ex	_											
		d over-exploitation, defore dies. Timber extraction, n			includi overus												
		nd their effects on forest a	_		enviror					*							
		Water resources: Use and			minera				_								
		on of surface and ground			degrad	ation	. Indi	vidu	als pl	ay a							
		drought, conflicts over wa			crucial				_								
		s and problems. Mineral re			resourc		_	omot	ıng								
		d exploitation, environment acting and using mineral re			sustain	aviili	ıy.										
		idies. Food resources: Wo															
		ns, changes caused by agri															
	and ove	ergrazing, effects of moder	n														
		ure, fertilizer-pesticide pro															
		ogging, salinity, case studi															
	Energy	resources: Growing energ	y neeas,														

	11 1 11			
	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			
III	<b>Ecosystems:</b> 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,		aquatic coosystems.	
	estuaries)			
IV	Biodiversity and its conservation:	5	This module covers	1,2
1 4	Introduction – Definition: genetic, species	3	biodiversity, including its	1,4
	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 classification, its status as a	
	use, social, ethical, aesthetic and option		*	
	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,	
<b>T</b> 7		_	crucial for conservation efforts.	1.0
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.		and officioninin chancinges.	
	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. 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										
Cours	e Title	Im	plicative English (	(Comm							i	
Cours	se code	23UBPD121R	Total Credits: 2		L	T	P	S	R	O/F	C	
			Total Hours: 32		0	0	2	0	0	0	2	
	equisite	Nil	Co-requisite		anah:	مامم		Nil				
	amme		Bachelor of Scienc									
Semes	ster		II semester of firs									
1. To equip students with the skills to interchange and correct common grammatical errors.  2. To enable students to effectively use one-word strand homophones, avoid commonly confused words.  3. To help students understand the nature and types to effective listening.  4. To enable students to apply effective reading te texts, and use the SQ3R technique.  5. To teach students the importance of time maintain it.  6. To guide students in developing a comprehensive					substi vords, es of li techni nanage	tutic and sten ques	ons, u use i ing, a s, gat nt an	indersidiom and o ther i	stand s and verce nforr sic s	homo d phra ome ba mation strateg	onyms ses. arriers a from ies to	
	CO1	Provide students with the address common gramma Empower students to prohomonyms and homopho	tical mistakes.  oficiently apply one	e-word	substi	itutio	ons, o	differ	entia	ite bet	ween	
	CO3	and phrases in their vocal Assist students in compr	oulary. rehending the vario	ous aspe	ects a	nd t						
		identifying and overcomi	ng obstacles to effe	ective lis	stenin	g.						
C	CO4	Facilitate students in e information from texts, an			_	rate	gies,	extr	actin	ig rel	evant	
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	d profes	sional	l Lin	kedI	n pro	file.			
Unit No.		Content	Contact Hour		Lear	rnin	g Ou	tcon	ie		KL	
I	i. Interc Asser Asser ii. Type	nar (flipped classroom) change of Interrogative and tive Sentences, Exclamator tive Sentences as of Tenses mon Errors	6	const sente	ents w truct a ence ty imatic	nd to	ransf and	orm corre			1,2, 3	
II	i. One ii. Hor iii. Wo <b>iv.</b> Idio	ulary Development word substitution monyms and Homophones ords often confused oms and phrases	6	vocal	ents w bulary rately	and in co	l use ontex	word tt.	ls		1,2, 3	
III	i. What ii. Type iii. Und	ng Skills is listening? s of Listening erstanding Listening Barrie		effec ident	ents w tive li ify lis	steni	ing s ng ba	kills arriers	and s.		1,2, 3	
IV	i. Techr ii. Gath text	g Skills niques of Effective Reading ering ideas and information SQ3R Technique		and e	ents wextract	t rele	evant	info	rmati		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		urricular Activities	s	ı	1	1	1	1	_
Course	e code	/41 BCCT/IR	redits: 1 nours: 60		T 0	P 0	<b>S 4</b>	R 0	0/F 0	C   1
Pre-re	quisite	Nil (	Co-requisite		ı	•	Ni	l		
Progra	amme	Bach	elor of Science in N	Micro	biol	ogy				
Semes	ter		mester of first year							
Course Objectives		<ol> <li>Develop students' interperse through participation in div</li> <li>Foster leadership qualities students to take on leadersh curricular activities.</li> <li>To be aware of their role in</li> </ol>	erse co-curricular ac and organizational s ip roles and manage a society and contrib	ctiviti skills e ever	ies. by protes or	rovidi projevely.	ng op ects w	pportu ithin	unities t	for
C	01	Improve Interpersonal and Tea and communicate better.	mwork Skills- Stude	ents v	vill le	arn to	worl	k well	l with o	thers
CO	02	Develop Time Management a their time and stay organized.	nd Organizational S	Skills	- Stu	ıdents	s will	learr	n to ma	nage
CO	<b>D3</b>	Boost Creativity and Critical T think more critically.	hinking - Students v	will e	nhand	ce the	ir crea	ative	abilitie	s and
CO	<b>D4</b>	Promote Physical and Mental Health - Students will improve their overall health and reduce stress.								
CO	<b>O5</b>	Encourage Social Responsibil aware of their role in society a	nd contribute positi	vely.						
Unit No.		Content	Contact Hour	I	Leari	ning (	Outco	ome	I	KL
I	improve develor organizativitical mental responsivities will en workship their in social and Renow workship evaluation workship evaluation workship experies with other manage creative health,	on the learner's interest they can ring interpersonal and teamwork ping time management and rational skills, boosting creativit thinking, promoting physical at health, and encouraging social sibility and civic engagement. To gage in regular club activities, alops, and competitions that align terests and hobbies, fostering the and emotional development. The professionals will conduct alops to enhance students' talents ments will include participation es, reflection essays, journals, actions of their involvement in alops and events. Through these ences, students will learn to work hers, communicate effectively, the their time, stay organized, enhity, think critically, improve the reduce stress, and contribute ely to society.	a skills, ay and and they a with aeir  in and k well ance	sport current study agil tear The mar prace through a wallifel ence pursued that	rts, mricular bugh lents sical ity, lents will hagen build le fos with. I mote build le fos with length ourage build le for length ourage with length	cipatir nusic, r activents universelved and neaders k, and l enhanent, knowworks d profestering These cultures, inclearning ging states in new services passi and beging to the control of	and devities resity of level on the ship, of the same	offer offer clubs, opp l trivity time with onals, dence sonal vities ity, at ts to ts, and	eed .	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					

			SEMESTE	R – III								
Cour	se Title			Immunolo	gy							
Cour	se code	23BSMB211R	Total credits: 4 Total hours: 4	4	L 3	T 0	P 2	S	R 0	O/F 0	C 4	
Pre-r	equisite	Nil	Co-requ		3	U	<u> </u>	Nil	_	U		
	ramme	1,12	Bachelor of S		 Iicrob	iolog	īV					
Seme		Fall/						nme				
Seme	5161	Fall/ III semester of second year of the Programme  1. Identify and describe the contributions of key scientists to the development of									nt of	
	ourse ectives	<ul><li>immunology.</li><li>2. Explain the functio</li><li>3. Differentiate between interactions.</li></ul>	<ul> <li>immunology.</li> <li>Explain the functions and properties of various immune cells and organs.</li> <li>Differentiate between types of immunity and understand antibody-antigen interactions.</li> <li>Analyse hypersensitivity, autoimmunity, vaccines, secondary immunodeficiency, and</li> </ul>							tigen		
(	CO1	Describe the historical	prospect and co	ncept of inr	ate an	d ada	ptive	imm	unit	y.		
C	CO2	Illustrate the propertie	s and functions of	of different	mmun	e cel	l, org	ans.				
C	CO3	Discuss the structure a		•		•						
C	CO4	Apply the principle of										
	CO5	Identify immunologica	al disorders like						•			
Unit No.		Content		Contact Hour	Learning Outcome			Learning Outcome				KL
I	Contrib develop Edward Koch, F Medaw	Concept of Innate and Adaptive immunity: Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa			Describe, illustrate and explain the contributions of scientists towards the development of Immunology					1,2		
II	Stem ce Macrop Basoph Immune	ns and Properties of: Im ell, T cell, B cell, NK cel hage, Neutrophil, Eosin il, Mast cell, Dendritic c e Organs – Bone Marrov Node, Spleen, GALT, N	ll, ophil, ell; and v, Thymus,	10	Descriexpla cells to prope	in ab heir	out I1	nmur	ne		1,2	
III	Immuni property	Lymph Node, Spleen, GALT, MALT, CALT Immunity – types - active passive Antibody – property structure, antigens– properties, happens,			Describe, illustrate and explain the different types of immunity, properties of antibody, antigen, happens and structure of antibody				s of	1,2		
IV	precipit	ation, immune diffusion	antibody reactions – agglutination, tion, immune diffusion, ELISA, RIA, nal antibodies functions			in the	e kno and p	rate a wledg proces ques	ge or	ı	1,2	
V	types, v	ensitivity – types, autoir accines – types, seconda odeficiency, graft and its	ary	9	immune techniques  Describe, illustrate and explain the different type of Hypersensitivity, vaccines, graft and secondary immune deficiency						1,2	

Practical	<ol> <li>ABO Blood Grouping and Rh typing</li> <li>Precipitation reaction: ODD, RID, WIDAL, VDRL / RPR, ASO, CRP, HCG</li> <li>Demonstration of RIA and ELISA</li> </ol>	30	Proficiency in various diagnostic disease diagnosis	1,2,3,4
<u> </u>	3. Demonstration of RIA and 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							
Cours	Course Title Microbial Genetics										
Cours	se code	23BSMB212R T	Total credi	ts: 4	L	T	P	S	R	O/F	C
Cours	se code	25D5WID212K T	Total hour	s: 45T+30I	2 3	0	2	0	0	0	4
Pre-r	equisite	Nil	Co-re	equisite				Ni	1		
Progr	amme	I	Bachelor o	f Science in	Micro	biolo	gy				
Seme	ster	Fall/ III	semester (	of second y	ear of t	he Pr	ogra	mme	e		
	ourse ectives	<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 structu	ure and its	mode of rep	olication						
(	CO2 CO3 CO4	Illustrate the concept of tr translational modification Describe the DNA mutati Explain bacterial recomb	in prokar	yotic and euge and their	karyotio repair m	c cell necha	s. nism		, trans	slation,	post
(	CO5	Outline transposable elen	nents and t	heir differer	nt applic	ation	1.				
Unit		Content		Contact	Le	earni	ng O	utco	me	]	KL
No. I	No.			Hour 9	Descril explair organiz their M	the zation	struc 1 of I	tural DNA	and		1,2
П	and replication.  Prokaryotic and eukaryotic transcription: Structure and processing of m-RNA, r- RNA, t-RNA. Ribozyme, Genetic code and Wobble hypothesis, Translation in Prokaryotes. Post translational modifications, Gene regulation and expression – Lac operon, tryptophane operons, gene rearrangement, promoters, enhancer elements.			10	Descril explain as trans translat prokary	abor script tion i	ut protion and to the termination of the terminatio	ocess and th	es suc	ch	1,2
III	Types of mutation directed and repai Bromide and repai Isolation	bes of mutagens, molecular basis of tations, analysis of mutations, site exted mutagenesis. Detailed mutagenesis repair mechanism of UV, Ethidium omide and Nitrus oxide. DNA damage repair mechanisms. Lation and applications of mutants.					erent d thei	r	1,2		
IV		Recombination's- Discovi molecular mechanism, dete		10	Descril explain						1,2

	efficiency calculation and applications.		of transfer of genes from one	
	Bacterial transformation- Competency and		organism to another	
	resistance.			
	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,	8	Describe, illustrate and	1,2
	detection of transposition in bacteria, types		explain about the	
	of bacterial transposons and applications of		rearrangement of genes are	
	transposons		major force in evolution	
	1. Gel casting and gel loading	30	Proficiency in various	1,2,3,4
घ	2. Isolation of DNA, protein		molecular techniques for	
	3. Agarose Gel Electrophoresis, PAGE		DNA, protein isolation	
Practical	4. Demonstration of conjugation,			
<u> </u>	transformation and Transduction			
	5. Blotting techniques			

- 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					

	SEMESTER – III										
Cours	se Title		Agricultural	l Microbiol	ogy and	l Plar	nt Pa	thol	ogy		
Cours	se code	23BSMB213R	Total credits Total hours:		L 3	T 0	P 2	S 0	R	0/F 0	<b>C</b> 4
Pre-r	equisite	Nil		quisite				Ni			
Progr	ramme		Bachelor	of Science i	n Micro	biol	ogy				
Seme	ster	Fall	/ III semester	of second y	ear of	the P	rogr	amm	ie		
_	Course .jectives	<ol> <li>Understand soil including siderop</li> <li>Explain the nitt nitrogenase funct</li> <li>Apply knowledge cyanobacteria in</li> <li>Analyze host-paproduction, and since the soil in the side of the sid</li></ol>	thore roles.  rogen cycle,  ion, and if gen  ge of bioferti  agriculture.  arasite intera	symbiotic ne important lizers, biop actions, pa	and notes. Desticide	on-sy es, ge esis	mbio enetic	otic 1	nitrog nsfor	gen fix	ation,
	CO1	Describe soil profiled dynamics of positive comprehending the and plants.	e and negative	ve interaction	ons bet	ween	mic	robes	and	plants	and
•	CO2	Proficient understand symbiotic nitrogen for and articulation of the	ixation mechai	nisms, clarif	ication	of nit	rogei	nase e	enzyn		
•	CO3	Applying the use of a for insect control, an and Agrobacterium-	d recognizing	the importai							
	CO4	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.									
	CO5	Study key plant dise harvest disease contri		control met	hods an	d pre	vent	ive st	rateg	ies for	post-
Unit No.		Content		Contact Hour	L	earni	ng C	Outco	me		KL
I	No.			9	Descri compo identif microo plant-r and ev siderop relation	sitior y soil organi nicro aluate ohore	n and and isms, be in the the	structure plant anal teracture role	cture, t yze tions,		1,2
II						1,2					
III	Transform as bioferti methods. action, an	zers, Biopesticides, an nation, Associative cy ilizers: Benefits and a Biopesticides: Types, d evaluation for insected its role in plant transcripts.	anobacteria pplication modes of t control. Ti	9	Descri explain Biopes Transf	be, ill n abo sticide	lustra ut Bi es, ar	ate ar ofert	id ilizers	s,	1,2

	Agrobacterium-mediated gene transfer: Mechanism and applications.			
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

			SEMESTE	R – III							
Cou	rse Title		English Lan	guage for l	Excelle	ence					
Cou	rse code	1 731/80177170 1	23UBPD212R Total credits: 2 Total hours: 32					S 0	R 0	O/F 0	C 2
Pre-	requisite	Nil	Co-requ	isite				Nil			I
Prog	gramme	-	Bachelor of S	Science in 1	Microl	biolog	gy				
Sem	ester	Fall/ I	II semester of	second yea	ar of th	he Pro	ogra	mme	<u>;</u>		
	ourse jectives	<ol> <li>To develop clear and</li> <li>To cultivate self-mand</li> <li>To understand and understand</li> </ol>	<ol> <li>To understand and apply grammar rules effectively.</li> <li>To develop clear and structured writing skills.</li> <li>To cultivate self-management skills.</li> <li>To understand and utilize non-verbal communication.</li> <li>To enhance group discussion skills</li> </ol>								
	CO1	Enable students to us sentences, and distingui					ompl	lex,	and	compo	ound
	CO2	Teach students the bas letters, and prepare result Help students conduct Shygiene.	imes and cover	letters.							
(	CO4	Equip students with k language, and their imp	-	out non-vei	bal co	ommu	nicat	ion,	type	s of b	ody
(	C <b>O</b> 5	Train students in plannariand summarizing to atta	•	cting group	discus	ssions	, effe	ective	ely di	isagree	eing,
(	C <b>O</b> 6	Prepare students for per telephone interview etic									llow
Unit No.		Content		Contact Hour	Learning Outcome		ome		KL		
I	i. Use of ii. Simple	ar (Flipped classroom) Prepositions e, complex, compound se e and Passive Voice	entences	6	prepo sente conve	ents work osition once steet between the voice with the contraction of	ns, cr tructu twee	eate ires,	vario and	ous	2, 3
II	Writing Skills  I. The Basics of Writing; avoid ambiguity and vagueness  II. Paragraph Writing  III.Letter Writing  IV. Resume and Cover Letter			6	and s	ents watructurs, resurs.	ıred p	oarag	raph		3, 4
III	i. SWOT ii. Self-R	SWOT Analysis Self-Regulation Personal Hygiene  5 Students will perform SWOT analyses, self- regulate, and adhere to personal hygiene practices.					3, 4				
IV	Body La i. What i Body La ii. Types	Non- Verbal Communication-Sciences of 5 Stude and 5 What is Non-Verbal Communication & type				ents weffecti of bo munica	vely ody la	use d	liffer	ent	2, 3

V	<b>Group Discussion</b>	5	Students will plan and	3, 4
	i. Planning and Elements of Group Discussion		participate in group	
	ii. Effectively disagreeing,		discussions, disagree	
	iii. Summarizing and Attaining the Objective.		constructively, and	
			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					

			SEMESTI	ER – III								
Cours	se Title		Basic L	ife Savin	g Sk	kills (	BLS	<b>S</b> )				
Cours	se code	23UULS202R	Total credits: 1 Total hours: 3		L 0	T 0	P 2	S 0	R	O/F 0		<u>C</u>
Pre-r	equisite	Nil	Co-requisi		U	U	<i>_</i>		Vil	U		1
	amme		Bachelor of		in N	Iicro	biolo	gy				
Seme	ster	Fall	/ III semester o	f second	yeaı	r of t	he Pr	ogra	mme			
	ourse ectives	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										
(	CO1	The students will be able to recognize respiratory arrest/ cardiac arrest, and provide oxygen to the patients to sustain tissue viability										
C	CO2	The students will be infants victims	able to perform	the impo	ortan	ice o	f earl	y CPI	R on A	Adult, o	child	d and
C	CO3	The students will be a pain and protecting t	_		_	_	worse	, aidi	ng rec	overy,	relie	eving
C	CO4	Importance of physio	logy in forestry									
C	CO5	The students will be able to learn about the fire equipment requirements, methods of operation and getting out alive.								ds of		
Unit No.		Content		Contac Hour	t	Le	earnii	ng Ou	itcom	e	K	KL
I	I Basic Life Support (BLS)  • Introduction of BLS  • Chain of survival  • ABCs Assessment  • CPR and Ventilation Technique  • AED  • Choking for adult and children			5	li c	ife su hain	ipport of su	, abor vival	ut bas ut the , diffe iiques		1	.,2
II	• Golder • First a	n rules of First aid		5	tl a u	he go ind bo itilize	olden e able e a fir	rules to pr st aid	derstar of firs epare kid ergen	t aid and	1	,2
III	<ul> <li>Trauma emergencies</li> <li>Introduction</li> <li>Priorities of Initial approach in pre-hospital care</li> <li>Scene safety</li> <li>Primary assessment</li> <li>Bleeding control</li> <li>Extrication of victims and safe transfer</li> <li>Cervical spine stabilization and C-collar application</li> <li>Splinting of broken Limbs</li> </ul>				Explains about different rauma emergencies and methods of managing trauma emergencies.						1,	2,3
IV	• Introde • Flow of • Triage	system		5	s; n	yster nultij	rates t n and ple ca tions.	expla	ains ab	oout	1,2	2,3,4

V	Medical emergencies	4	Describes different types	1,2,3,4,5
	Introduction		of medical emergencies	
	Victim centred approach and Management		and its management.	
	of:-			
	• Seizures			
	• heart attack			
	• asthma			
	diabetic emergencies			
	emergency childbirth			
	Respiratory distress and failure			

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 – III													
Cours	se Title		Person	rsonal Financial Planning										
Cours	se code	23UUFL202R	Total credits: 2		L	T	P	S	R	O/F	' (	2		
			Total hours: 30		0	0	2	0	0	0	2	2		
	equisite	Nil	Co-requisit	of second year of the Programme sive approach to understand the relevant concepts of and their application to financial planning. Inning process, the life cycle of financial plans, and eping system, and tax planning strategy based on gy and a plan to facilitate the home or automobile ortfolio that addresses several different investment osed-end mutual funds, exchange-traded funds, and ents.										
Progr	amme		Bachelor of S	Contact   Learning Outcome   L										
Semes	ster	Fall	/ III semester of s	second ye	ear o	of the	Prog	ramn	1e					
		1. The course would	offer an inclusive	approac	h to	unders	stand	the re	levant	conc	epts o	of		
			-						_	-				
	ourse ectives	2. Assess the person	al financial planni	ng proce	ess, tl	he life	cycle	e of fi	inancia	al plar	ns, ar	nd		
Obje	ectives	methods of goal a												
			_	g system	n, an	nd tax	plan	ning	strateg	gy bas	sed o	on		
		current financial g	oals											
	CO1	Develop a cash management strategy and a plan to facilitate the home or automobile												
<u> </u>	- •	buying process	investment	olio that	.44	*00000	00773	.o1 .1:	fforma == f	. in	atm =	n+		
C	<b>O2</b>	objectives.	mvesiment portio	ono tnat	audi	iesses	sevel	ai ai	neren	ı mve	sune	IIL		
	03	č	n open- and closed	d-end mu	ıtual	funds	, excl	nange	-trade	d fund	ds, ar	nd		
C	03	direct or indirect real	direct or indirect real estate investments.											
$\mathbf{C}$	<b>O</b> 4	_	Create a financial plan that covers your income needs in retirement and helps protect you											
		and your estate.	, 1 1	1 CC	,•		. ,	r						
	<b>O</b> 5													
	U5	financial stability and		us estate	pian	iiiiig a	iiid ie	gar p	lotecti	on to	ensu	16		
Unit		Content	i security.	Contac	t	Lea	rning	Out	come		KL			
No.				Hour				•						
I		nentals of Financial I	Planning —	6							1,2			
		ions of money;	1							.1				
		tion- Meaning, causes, colled;	now it can be					S OI II	mancia	all				
		ess official planning,			P	'iaiiiiii	5							
		e value of money-simp	le and											
	_	pound interest;												
		Present Value and Futu	re value,											
		er of Compounding; bling period and Rule	of 72											
			01 72.											
II		Tax Planning—		6						,	1,2			
		ing of Income, ct & Indirect Taxes, Ta	vahle Income						-	1				
		ous heads of Income fo						iiic ta	ıA					
		ulation,			r		0							
		-taxable Income,												
		evasion and tax avoida												
TIT		Tax Planning Strategi	es	6	9	tudont	- vvi1	Loggi	iro		1.2			
III		<b>reneurial planning –</b> ing of Entrepreneurshi	n nrerequisites	0				_			1,2			
		coming an entreprenet							-					
		preneurship Support S												
	iii. Ins	stitutional support syst	~											
		oreneurs,	,											
		ncial support systems												
		ure Capital, Business A stant of Government,	angeis,											
		-	and Overdraft											
	, II. COI	Dunk Louis (	al Bank Loans and Overdraft.											

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

- 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										
Cour	se Title			alytical Bi	iochen	nistry	7							
Cour	se Code	23BSMB214R	Total Credits: Total Hours:		<b>L</b> 0	T 0	P 2	<b>S 0</b>	R 0	0/F 0	1			
Pre-r	equisite	Nil	Co-requi	site	,	'		Nil	•	•	•			
Progr	ramme		Bachelor of	Science in	ı Micr	obiol	ogy							
Seme	ester	Fall/	III semester of	second y	ear of	the P	rogr	amm	e					
Course Objectives		underlying analytic spectroscopy (UV electrophoresis, material 2. Quantitative Anatanalysis of biomolemetabolites using volumetabolites volumetabolites using volumetabolites volumetabolites volumeta	<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>											
	CO1	Acquire concept of bo	uffer solutions a	nd their ro	le in v	arious	s exp	erime	nts.					
	CO2	Develop basic unders	tanding on acid	and base,	pH of	soluti	on a	nd use	of p	oH meters.				
(	CO3	Apply the principle spectrophotometer.	e of Lambert-E	Beer law	with	the	help	of o	colori	imeter	and			
(	CO4	Explain biomolecule separation through thin layer chromatography.												
(	CO5	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	3	5		ficieno paratio	•	buffe	r	3	,4, 5			
II	Determi pH mete	nation of pH of given s er	amples using	7	ope vari	ficiend ration lous and meter	and nalyt	functi	on of	f	,4, 5			
III	Verification of Beer- Lambert's Law			6	Relating the theoretical concepts with practical application in terms of Beer-Lambert Law verification					3	,4, 5			
IV		on of a mixture of lipid nromatography	ls using Thin-	5		Proficiency in 3,4 Chromatography technique								
V		nromatographic separation of amino acids and si		7	Proficiency in separation and detection of amino acids and simple sugars									

1. Introductory Biochemistry Practical by Sawhney and Singh, Narosa Publishing House

- 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	S _ III							
Cours	se Title		SEMIESI EI	<u>X = 111</u> Entomole	ogy						
	se Code	23FSZO301R	<b>Total Credits:</b>	2	L	T	P	S	R	O/F	C
			Total Hours:		2	0	0	0	0	0	2
	equisite	Nil	Co-requ		/ionab	iolor		Ni	<u> </u>		
	amme	E-11/1	Bachelor of S								
Semes	ster	1. Understand the class	II semester of s						inco	oto for	nicina
	ourse ectives	on Class Insecta.  Explore the morpho Analyze the life cyclimpact on human he Investigate insect comanagement and for	logy and adaptareles and control alth.	tions of insomeasures of	ect mo	uthpa licall	arts, a y im _j	anteni portar	na, ar nt pes	nd legs sts and	s. 1 their
C	CO1	ets different	morp	holog	gical	modi	ficati	ons.			
(	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 to	echni	iques	and	inse	ct bel	havior
(	CO4	Able to explain, illust controlling insect pests	•					t strai	tegy	adopte	ed for
	CO5	Gain knowledge on dif	terent insects of							ı	
Unit No.		Content	Contact Hour	Learning Outcome						KL	
I	Class Ir Insect n	action to Entomology: On secta, its classification an anorphology: Overview an eations of mouthparts, an	5	Describe and explain the class of Insects and its morphological peculiarities.					es.	1,2	
II	control aegypti, Phlebon Cordylo damnos	medical importance: L measures of Musca dom , Culex quinquefasciatus tomus spp, Glossina fusc obia anthropophaga, Sim cum, Pulex irritans, Cime na infestans, Pediculus ha	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	Insect communication: Chemical communication, Audio and tactile communication, Visual communication, Luminescent insects Insect Behavior: Chemotropism, Thigmotropism, Hydrotropism, Rheotropism, Anemotropism, Phototropism, thermotropism and geotropism.			6	Describe, illustrate and explain the process of different communicating techniques and insect behavior adopted by insects.						1,2
IV	about clinsect's	insects in pest manager hemical and biological co- pest, insects in forensic science	5	mana	in th geme ted fo	e dif	ferent	<b>y</b>		1,2	
V	Life cyc	ction to Applied Entongle, by product and comming of honey bee, silkwo	7	Desci expla insec impo		1,2					

- 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							

			SEMESTE	ER – III								
Cours	se Title		- ·	Forest	ry		-	T =	~	T	-	
Cours	se Code	23FSBO301R	Total credi Total hours			<u>L</u>	T 0	P 0	<u>S</u>	R	0/F 0	C 2
Pre-re	equisite	Nil		requisite					Ni	il		
Progr	amme		Bachelor of	Science in	Micro	biol	logy					
Semes	ster	Fall/ II	I semester o	f second ye	ear of t	he I	Prog	gran	ıme			
	ourse jectives	2. Basic knowledge of f	<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>O</b> 1	Articulate the history and	Articulate the history and basic concept of Forestry.									
(	CO2	Importance of Dendrolog	gy and know	ledge of wo	ood for	est						
(	CO3	Understanding of forest	Understanding of forest types and forest management									
	CO4	Importance of physiology in forestry										
	CO5	Understanding the forest	t pathology,		orest dis	seas	es					
Unit No.		Content		Contact Hour		Lea	rnin	g Ō	utco	me		KL
I	Classific forest typ policies i Forest n of forest manager	roduction Forestry: History of forestry, ssification of forest, Basic concepts on est types of India. Important acts and icies related to Indian Forest.  rest management: Definition and scope forest management, principle of forest magement and their applications			Describe and explain History, types and policies of forest					-	1,2	
II	scope of morpholoflora Ecotourise	dendrology. Role of vege ogy in identification of wo ism: Definition and elements, Principles and objection. Potential of ecotourism	tative cody forest ents of ves of	7	Describe, illustrate and explain Importance, scope and morphology of woody forest and Ecotourism					1,2		
III	physiolo forest tre canopies and deve	nysiology: Introduction to gy, Photosynthesis. Water ees, transpiration from fores, environmental effects or elopment.	relation of est a growth	6	Describe, illustrate and explain Importance of tree physiology in relation to forestry.				,	1,2		
IV	of India, compone cycling, measure	Coology and Diversity: For Forest Ecosystem-abiotic ents and their interaction, I forest management. Consement 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.				otic	1,2		
V	patholog causes of patholog	Pathology: 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	Describe, illustrate and explain Principle of forest pathology causes of forest diseases and plant quarantine.							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

- 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								
Cours	se Title		Curricular Activ	rities							
Cours	se code	23UBCC211R	Total Credits: 1 Total Hours: 60		L 0	T 0	P 0	<b>S 4</b>	R	O/F 0	C 1
Pre-re	equisite	Nil	Co-requ	isite	Nil						
Progr	amme		Bachelor of Scie	nce in Mici	obiol	ogy					
Semes	ster	Fall/ II	semester of seco	ond year of	the P	rogr	amı	me			
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>									
(	C <b>O</b> 1	Improve Interpersonal a others and communicate	better.								
	CO2	Develop Time Managen their time and stay organ		ationai SKII	ıs - St	uuen	is W	111 16	arn t	o man	age
(	C <b>O3</b>	Boost Creativity and Cr and think more critically	itical Thinking -								
CO4		Promote Physical and Mental Health - Students will improve their overall health and reduce stress.									
(	C <b>O</b> 5	Encourage Social Responsibility and Civic Engagement - Students will become more aware of their role in society and contribute positively.									
Unit No.		Content		Contact Hour	Le	earni	ing (	Outo	come	1	KL
I	interpersettime man boosting promotine encourage engagem activities with their social and profession students' participate journals, workshop students communication organized improve	onal and teamwork skills, agement and organization creativity and critical thirting physical and mental heating social responsibility at ent. They will engage in responsibility at the entire and hobbies, for demotional development and will conduct workshout talents. Assessments will tion in activities, reflection and evaluations of their in ps and events. Through the will learn to work well with icate effectively, manage definition, entire the effectively, thin their health, reduce stress y to society.	developing nal skills, nking, nking, nlth, and nd civic regular club tions that align stering their Renowned ops to enhance include n essays, nvolvement in ese experiences, th others, their time, stay k critically,	60	By povarious co-culative will of mentite team. They mana pract through and be while grow and lencor pursu develocultive acade	us sparriculatives ities ersitydevel al ag work will agem ical lagem would be fost th. Thoote considered in the control of the	oorts ular offer clul op p ility c, and ent, knov orks proofs proofs clultu hese cultu ng s eir ir ew s passid be	red t bs, s shysin, lead created to the shop of the shop of the shift	hroughtuden tuden teativite time so with the time to t	gh and gh ats and hip, ty. Et al. s	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			

		SEMESTI	ER – IV							
Cours	se Title	I	lar Biology	and RDT						
Cours	se code	23BSMB221R Total cr		L	T	P	S	R	O/F	
Pre-r	equisite		ours: 45T+3 o-requisite	30P 3	0	2	0 N	o Vil	0	4
	ramme	Bachelor of		Microbiol	ogy			111		
Seme	ster	Spring/ IV semester				gran	nme	;		
	ourse ectives	<ol> <li>To teach kea topics like DNA structure, central dogma, modifications in RNA and proteins, DNA repair and recombination.</li> <li>To make students aware of various molecular biology techniques.</li> <li>To make students understand the key topics like cloning, vectors, DNA sequencing, Genome mapping</li> <li>To make students understand the application of RDT</li> </ol>								
C	CO1	Describe the role of DNA as genetic	material, its	replicatio	n an	d tra	nscı	iptio	on	
C	CO2	Explore the bacterial Recombination				,	g th	eir	DNA	repair
	CO3	mechanisms and applying the basic in Summarize various restriction enzym					Т			
	CO4	Applying the DNA amplification tec								
	CO5	Describe the various gene transfer producing pharmaceutical proteins.					NA	tec	hnolo	gy for
Unit No.		Content	Contact Hour	Lear	ning	Ou	tcon	ne		KL
I	DNA as RNAs a the carr Chromo Central Enzyme replicat transcri	lar biology an overview: Discovery of a genetic material, Structure of DNA, and their structure & function, DNA as ier of genetic information, osomes, chromatin and function, The Dogma. Eukaryotic DNA Replication: es and proteins involved in DNA ion. Eukaryotic Transcription, post ptional modifications Eukaryotic ion, post translational modification	12	Describe DNA str replication and transeukaryot	uctu on. T slatic	re, Frans	scrip			1,2
II	model) DNA re excision Basic M a. Isolat DNA b. Agard c. South d. North	pination: Homologous (Holliday and non-homologous recombination epair: Base excision repair, nucleotide a repair, Mismatch repair, SOS repair. Holecular Biology Techniques aion of plasmid DNA, chromosomal cose gel Electrophoresis aern blot hern blot ern blotting	7	Describe explain I recombin molecula techniqu isolation	Procenation ar bid es fo	ess on, boologs of Di	of asic y NA			1,2
III	enzyme enzyme polymet transfer enzyme bacterio	ew Gene cloning tools - Restriction s- class I, II and class III restriction s, and their features. Ligases, rases, alkaline phosphatases, kinases, ases and other DNA engineering s. Vectors - Plasmid vectors, ophage, cosmids and phagemids, tion vectors, shuttle vectors	7	Describe explain t for gene applicati	he d	iffer	ent	tool	s	1,2

IV	DNA amplification through PCR: Basic features and applications of PCR, types and modifications.  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	8	Describe, illustrate and explain the principle and process of PCR. DNA Sequencing process, Genome mapping and localization of a gene.	1,2
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					

		SEMEST	ER – IV									
Cour	se Title		ophysical C	hemistry								
Cour	se Code	23BSMB222R Total cre	dits: 2	L	T	P	S	R	O/F	C		
		Total ho		2	0	0	0	0	0	2		
	equisite		o-requisite				Ni	il				
Progr	ramme	Bachelor of Science in Microbiology										
Seme	ster	Spring/ IV semester of second year of the Programme										
		1. Understand pH, buffer systems, and the properties of water, including buffering										
		action and capacity, and the Henderson-Hasselbalch equation.										
		2. Explore quantum mechanics concepts, including atomic structure, black body radiation, Planck's law, photoelectric effect, and hybridization.										
	ourse			•			1.	1.	4 !	1_1		
Obj	jectives	3. Analyze chemical bonding types bonds, and van der Waals forces.	such as ioni	c, covaien	it, nyo	aroge	en b	onas	, pepti	ayı		
		4. Comprehend the principles	of thermod	vnamics	incl	udin	σt	he	laws	of		
		thermodynamics and their significance in biological systems, and the concepts of protein folding and cell membrane biophysics.										
(	C <b>O</b> 1	i	Explain the concepts of pH, buffers and related theories.									
(	CO2	Explain quantum mechanics and the laws associated with it.										
(	CO3	Illustrate the different types of bond										
	CO4	Outline the laws of thermodynamics										
(	C <b>O</b> 5	Explain the mechanism of protein for	Explain the mechanism of protein folding.									
Unit		Content	Contact	Lea	arnin	ıg Oı	utco	me		KL		
No.			Hour									
I	PH & B	uffer: Introduction; Bronsted & Lowr	7 <b>7</b>	Describe	e, illu	strat	e an	d		1,2		
I -		•						_				
	theory; I	Lewis theory; Buffering action; Buffer		explain		uffei		d				
	theory; I Capacity	Lewis theory; Buffering action; Buffer, H-H equation; Biological Buffers;				uffei		d				
	theory; I Capacity Propertie	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water		explain related t	heori	uffei es	rs an			1.2		
II	theory; I Capacity Propertion	Lewis theory; Buffering action; Buffer y; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape		explain related t	heori e, illu	ouffer es strat	rs an	d	·s	1,2		
	theory; I Capacity Propertion Quantum of atomi	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation;		explain related t  Describe explain	heori e, illu quant	es es strat	e and	d nanio		1,2		
	theory; I Capacity Propertion Quantum of atomi Plank's	Lewis theory; Buffering action; Buffer y; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape		explain related t	heori e, illu quant	es es strat	e and	d nanio		1,2		
II	theory; I Capacity Propertion Quantum of atomi Plank's Hybridia	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.	6	Describe explain and the it.	heori e, illu quant laws	es es estrate cum r	e and mech	d nanio d wi				
	theory; I Capacity Propertion Quantum of atomi Plank's Hybridiz Chemica	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.	6	Describe explain and the it.	heori e, illu quant laws	es estrate cum r assoc	e and mechainte	d nanio d wi	th	1,2		
II	theory; I Capacity Propertion Quantum of atomi Plank's Hybridiz Chemica	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.	6	Describe explain and the it.	heori e, illu quant laws e and	es estrate strate associ expl	e and mechainte	d nanio d wi the forc	es			
III	theory; I Capacity Propertion Quantum of atomi Plank's Hybridiz Chemica bond; Pe	Lewis theory; Buffering action; Buffer, H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  al bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces	5	Describe explain and the lit.  Describe different for inter	e, illu quant laws e and t bond action	strate strate sum rassoci expl ding n of a	e and a mo	d nanio d wi the forc	es le	1,2		
II	theory; I Capacity Propertion Quantum of atomi Plank's Hybridia Chemica bond; Pe	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  al bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces  dynamics: First law (concept of	6	Describe explain and the it.  Describe different for inter	e, illu quant laws e and t bond action	strate strate sum rassoci expl ding n of a	e and a mo	d nanio d wi the forc	es le			
III	theory; I Capacity Propertion Quantum of atomi Plank's Hybridiz Chemica bond; Pe	Lewis theory; Buffering action; Buffer, y; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; ration structure of atom.  al bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces  dynamics: First law (concept of energy); Second law (free energy,	5	Describe explain and the lit.  Describe different for inter  Describe explain	e, illuquant laws and too actione, illu	estrate estrate expl ding n of a	e and a mode and	d nanio d wi he forcolecu	es le	1,2		
III	theory; I Capacity Propertion Quantum of atomi Plank's Hybridiz Chemical bond; Per Thermod internal enthalpy	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  al bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces  dynamics: First law (concept of	5	Describe explain and the it.  Describe different for inter	e, illuquant laws and too actione, illu	estrate estrate expl ding n of a	e and a mode and	d nanio d wi he forcolecu	es le	1,2		
III	theory; I Capacity Propertion Quantum of atomi Plank's Hybridia Chemica bond; Per Thermod internal enthalpy system, the laws	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  All bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces  dynamics: First law (concept of energy); Second law (free energy, entropy); free energy in biological 3rd law; Significance and limitation of the content of th	6 5 7	Describe explain for inter  Describe different for inter  Describe explain the laws	e, illuquant laws a e and t bond action e, illu	esstrate expl ding n of a	e and a mode and odyn	d nanio d wi he forc blecu d	es le	1,2		
III	theory; I Capacity Propertion Quantum of atomi Plank's Hybridia Chemica bond; Pe  Thermod internal enthalpy system, the laws Concept	Lewis theory; Buffering action; Buffer, y; H-H equation; Biological Buffers; es of water n mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  al bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces dynamics: First law (concept of energy); Second law (free energy, y, entropy); free energy in biological 3rd law; Significance and limitation of soft protein folding: (Amino acids,	5	Described and the lit.  Described different for inter  Described explain the laws	e, illuquant laws actione, illu	expl expl ding n of a strate	e and a modyn	d nanid wi the force plecu	es le	1,2		
III III	theory; I Capacity Propertie Quantum of atomi Plank's Hybridia Chemica bond; Pe  Thermod internal enthalpy system, the laws Concept hydroph	Lewis theory; Buffering action; Buffer; H-H equation; Biological Buffers; es of water mechanics: Atomic structure (Shape c orbital); Black body radiation; law; Photoelectric effect; zation structure of atom.  All bonding: Ionic, Covalent, Hydroger eptidyl bond; Vander Waal forces  dynamics: First law (concept of energy); Second law (free energy, entropy); free energy in biological 3rd law; Significance and limitation of the content of th	6 5 7	Describe explain for inter  Describe different for inter  Describe explain the laws	e, illuquant laws actione, illu of the	expl ding n of a	e and a modyn	d nanid wi the force plecu	es le	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			Bioinforn	natics						
Cours	se Code	23BSMB223R	Total cred		L	T	P	S	R	O/F	C
			Total hour		0P 2	0	2	0	21	0	3
	equisite ramme	Nil R		-requisite	Microbiol	nav.		N	11		
Seme				cience in Microbiology f second year of the Programme							
	course	1. To give basic computer knowledge and their practical application.									
	jectives	2. Knowledge on computational database management system and its application in Biology									
	CO1	3. A basic idea on the structural biology using computer.  Explain the basics of computer and its applications in Biology, including data analysis									
	CO2	Explain the basis and app				ogy,	IIICI	uum	ig ua	ita aiia	19515
	CO3	Inculcate the foundation									
	CO4	To impart knowledge on				struc	ture	data	abas	es	
	CO5	Develop skills in using be									
Unit		Content		Contact	Lear						ΚL
No.				Hour							
I	_	Fundamentals- History of	etion of	5	Describe				140		1,2
		s, Generations and Classific s, Hardware and Software c			fundame						
	Block Dia		опсеры,	and its capabilities and limitation							
	Digital C	omputer, Limitations and									
		es of computers, I/O device									
		RAM ROM, Memory unit- p	orimary								
	and Auxi	•									
II		on to MS office Tools- MS on, starting MS Word, Stan		5	Describe					1	1,2
		le, edit, view, formatting a t			explain use of MS office tools in Biology,						
		nserting a diagram, graph, p		networking, multimedia					lia		
		borders, bullet & numberin			and its us	ses					
		mar, letter and mailing, mai	<i>U</i> ,								
	PowerPoi	l its applications. MS Excel	and MS								
		nd Networking - Introduction	on,								
		ce, Network– LAN, MAN, '									
		Mailing, Chatting, Search	•								
	_	es, Virus, Antivirus, Malwai									
		lia- Introduction, Application nts and its Uses.	ns,								
III	_	management system (DBM	S) -	5	Describe	, illu	strat	te an	d	1	1,2
	Introducti	on to database management			explain f			of a	ì		
	(DBMS)	and its different types.			database			1.			
					application						
IV		on to bioinformatics and da		7	Describe						1,2
	_	n- What is bioinformatics an			explain b						
		vith molecular biology. Exai ols (FASTA, BLAST, BLA	_		its relation biology a						
		L), databases (GENBANK,			ororogy a	1	ա ար	PIIC	auOl		
	PDB) and	l visualization software (RA	SMOL,								
		iewer, MolMol etc). Applic									
	Bioinformatics, Pharmaceutical companies and										

	Bioinformatics. Flat file formats. Protein homology modelling, physiochemical property 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 Mic	crobiology	y								
Cour	se Code	23BSMB224R	Total credits: 4		L	T	P	S	R	O/F	C		
			Total hours: 45T	T+30P	3	0	2	0	0	0	4		
	equisite	Nil	Co-requisi					Ni	l				
	ramme	=-											
Seme	ster		V semester of secon										
		1. To teach students the n	•				_		tors	that af	fect		
	ourse	the presence, survival, growth and death of microorganisms in food.											
Obje	ectives	<ul><li>2. To teach students about the principles of food preservation techniques</li><li>3. To teach students about the microbiology of various food and dairy products and the</li></ul>											
		pathogenesis of the foo					u uai	ry pr	ouuc	is and	uie		
		Understanding the va					ent	food	ls ty	vnes	and		
C	CO1	comprehending the fund							•	y pes	una		
		Remembering the variou								ds of f	food		
C	O2	preservation with the Ap											
		Determine the basic com	position of milk and	its nutritio	onal	com	pone	ents v	vith t	he fac	tors		
C	<b>CO3</b>	influencing the quality of	f milk and Recogniz	zing sourc	es o	of co	ntam	inati	on in	milk	and		
		examining the fermentation processes of cheese, butter, and buttermilk.											
C	04	Remembering the various food borne diseases with their causative agents and preventive											
		measures.	measures.  Analysis the various Detection Methods of water samples and understanding the										
C	05	*			-	ples	and	und	ersta	nding	the		
<b>T</b> T •4	1	Membrane Filter Technic	que and Hands-On C						4		TZT		
Unit No.		Content		Contact Hour		Lea	rnın	g Ou	itcon	ne	KL		
<u>I</u>	Introdu	ction To Food Microbiolog	y: Natural flora	9									
	and Sou	arces of contamination of fo	oods in general.		th	ne ge	nera	l mic	robe	s			
		ial spoilage: principles, intr						foods					
		that affect growth and surv poilage of vegetables, fruit						t sup 1 spo					
		canned foods.	s, meat, 055s,		_			od pr	_				
II		les and methods of food pre		9				llust			1,2		
	_	les, physical methods of fo	•			•		prin	-				
		nperature, High temperature Canning; Irradiation; Chem						ds of on tec					
		eservation: salt, sugar, orga			P	CSCI	valic	)11 tCC	ımıq	luc			
	antibiot	ics.											
III		microbes in milk and dairy		9				llust			1,2		
	-	sition of milk, Sources, cor e of milk and milk products						e com					
		ological analysis of milk. I						tion (					
		-	ıtter, buttermilk,					rodu					
	curd							crobi	_				
						-		milk dairy		the			
						rodu		auii y	,				
TV Facility		orna Disassas Dafinition a	of food poisoning	9	Î			11,104	rate and 1,2				
IV		orne Diseases- Definition of fections and toxication. Can		7				nusu vari		ıııu	1,2		
	foods in	nvolved, symptoms and pre	ventive measures.		ty	pes	of fo	od b					
		toxications: Staphylococcu					es, tl						
	Clostridium botulinum and mycotoxins;				pa	athog	gene	S1S,					

	Food infections: Bacillus cereus, Escherichia coli, Shigella, Listeria monocytogenes, Salmonella, Cholera		symptoms, and prevention	
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

Course Title   Course code   23BSMB223R   Total credits: 1		SEMESTER – IV												
Pre-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Co-requisite   Nil   Semester   Bachelor of Science in Microbiology   Semester   Spring/ IV semester of second year of the Programme   1. Develop proficiency in aseptic techniques for handling microorganisms safely a preventing contamination in microbial cultures.   2. Acquire skills in culturing and isolating diverse microorganisms from nature environments, clinical samples, and industrial sources.   3. Understand the principles of microbial growth kinetics and physiology by monitoring growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemical assays.   CO1   Proficient in aseptic techniques to prevent contamination.   CO2   Ability to prepare diverse culture media for microbial growth.   CO3   Competence in isolating and identifying microorganisms using various techniques.   CO4   Understanding of culture maintenance principles and preservation methods.   CO5   Develop critical analysis skills and troubleshoot common issues in microbial culture   Valuation of Content   Content   Contact   Hour   Learning Outcome   Kill   Preparation of liquid, semi solid and solid media (plates and slants).   Isolation of Pure culture from different sources.   Serial dilution, pour platting, spread platting, streak platting)   Proficiency in various microbial culture   1,2, techniques for bacterial and fungal identification.   Iv   Interpretation of colony characteristics on   7   Interpretation of colony characteristics on   7   Interpretation of growth parameters:   Valuation of growth parameters:   Va	Cours	se Title			e Techniq	•								
Pre-requisite Nil Co-requisite Nil Co-requisite Nil Programme  Bachelor of Science in Microbiology  Semester Spring/ IV semester of second year of the Programme  1. Develop proficiency in aseptic techniques for handling microorganisms safely a preventing contamination in microbial cultures. 2. Acquire skills in culturing and isolating diverse microorganisms from nature environments, clinical samples, and industrial sources. 3. Understand the principles of microbial growth kinetics and physiology by monitoring growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques:  I Preparation of liquid, semi solid and solid media (plates and slants).  II (Serial dilution, pour platting, spread platting, streak platting)  II Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fundation of growth parameters:    Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of growth parameters:   Valuation of	Cours	se code	73RSMR773D								C			
Programme   Bachelor of Science in Microbiology   Spring/ IV semester of second year of the Programme   1. Develop proficiency in aseptic techniques for handling microorganisms safely a preventing contamination in microbial cultures.   2. Acquire skills in culturing and isolating diverse microorganisms from naturenvironments, clinical samples, and industrial sources.   3. Understand the principles of microbial growth kinetics and physiology by monitoring growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.   CO1			]			0 0	2			0	1			
Course Objectives		_												
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Course Objectives  2. Acquire skills in culturing and isolating diverse microorganisms from nature environments, clinical samples, and industrial sources. 3. Understand the principles of microbial growth kinetics and physiology by monitoring growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  In Bacterial and Fungal Culture Techniques:  I Preparation of liquid, semi solid and solid media (plates and slants).  I I I I I I I I I I I I I I I I I I I	Senies	5161							ns sa	afely a	nd			
Course Objectives  2. Acquire skills in culturing and isolating diverse microorganisms from nature environments, clinical samples, and industrial sources.  3. Understand the principles of microbial growth kinetics and physiology by monitoring growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques:  1 Preparation of liquid, semi solid and solid 7 media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting)  Streak platting) Proficiency in various microbial culture techniques for bacterial and fungal identification.  IV Interpretation of colony characteristics on 7 different media.														
Course Objectives  environments, clinical samples, and industrial sources.  3. Understand the principles of microbial growth kinetics and physiology by monitori growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture unit No.  Content  Contact Hour  Bacterial and Fungal Culture Techniques: Preparation of liquid, semi solid and solid media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  Solidion, pour platting, spread platting, streak platting)  Culturing in basal media, differential media, selective media and enriched media.  To Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:						croor	oanio	eme	from	n nafu	ra1			
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growth parameters such as optical density, colony-forming units, biomass, a metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques: Preparation of liquid, semi solid and solid media (plates and slants).  I Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  TO Culturing in basal media, differential media, selective media and enriched media.  To Interpretation of colony characteristics on different media.  To Interpretation of growth parameters:	Obj	ectives	•	* *										
metabolic activity using spectrophotometry, viable cell counts, and biochemic assays.  CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour  Bacterial and Fungal Culture Techniques:     Preparation of liquid, semi solid and solid media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  III Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:				-					-		_			
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CO1 Proficient in aseptic techniques to prevent contamination.  CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture  Unit No. Content Contact Hour  Bacterial and Fungal Culture Techniques:  I Preparation of liquid, semi solid and solid media (plates and slants).  I Isolation of Pure culture from different sources.  (Serial dilution, pour platting, spread platting, streak platting)  II Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:			* * *	eu opiiotoineu y,	vidore ce	11 00	<i>a</i> 1105,	und	010	CHCHIN	cui			
CO2 Ability to prepare diverse culture media for microbial growth.  CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques:  I Preparation of liquid, semi solid and solid media (plates and slants).  I Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  III Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:    Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth parameters:   Fivaluation of growth	C	CO1	<u> </u>	to prevent contar	nination.									
CO3 Competence in isolating and identifying microorganisms using various techniques.  CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques: Preparation of liquid, semi solid and solid media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  Tu Culturing in basal media, differential media, selective media and enriched media.  To Interpretation of colony characteristics on different media.  To Interpretation of growth parameters:  The Contact Hour Contact Learning Outcome KI  The Contact Hour Learning Outcome MI  The Contact Hour Learning Outcome MI  The Contact Hour Learning Outc	C	CO2	Ability to prepare diverse cultur	e media for micro	media for microbial growth.									
CO4 Understanding of culture maintenance principles and preservation methods.  CO5 Develop critical analysis skills and troubleshoot common issues in microbial culture.  Unit No. Content Contact Hour Learning Outcome KI  Bacterial and Fungal Culture Techniques:     Preparation of liquid, semi solid and solid media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  To Culturing in basal media, differential media, selective media and enriched media.  To Interpretation of colony characteristics on different media.  To Interpretation of growth parameters:  To Develop critical analysis skills and troubleshoot common issues in microbial culture  Learning Outcome KI  Proficiency in various microbial culture techniques for bacterial and fungal identification.	C	CO3	· · ·				vario	ous to	echni	iques.				
CO5   Develop critical analysis skills and troubleshoot common issues in microbial culture   Unit No.   Content   Contact Hour   Learning Outcome   KI	C	CO4												
Unit No.         Content         Contact Hour         Learning Outcome         KI           I Preparation of liquid, semi solid and solid media (plates and slants).         7         Preparation of liquid, semi solid and solid media (plates and slants).         7           II (Serial dilution, pour platting, spread platting, streak platting)         5         Proficiency in various microbial culture techniques for bacterial and fungal identification.         1,2, techniques for bacterial and fungal identification.           IV Interpretation of colony characteristics on different media.         7         7		CO5								culture	es.			
No.    Bacterial and Fungal Culture Techniques:   I Preparation of liquid, semi solid and solid media (plates and slants).    Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)    III   Culturing in basal media, differential media, selective media and enriched media.    IV   Interpretation of colony characteristics on different media.    Interpretation of growth parameters:   In		 			1					1				
I Preparation of liquid, semi solid and solid media (plates and slants).  I Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  T Culturing in basal media, differential media, selective media and enriched media.  T Interpretation of colony characteristics on different media.  T Interpretation of growth parameters:			Content		Learning Outcome						L			
media (plates and slants).  Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, and fungal identification.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.  The culturing in basal media, differential media, selective media and enriched media.														
II Isolation of Pure culture from different sources. (Serial dilution, pour platting, spread platting, streak platting)  III Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:	I			7										
II (Serial dilution, pour platting, spread platting, streak platting)  III Culturing in basal media, differential media, selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:		*	<u> </u>		-									
streak platting)  Proficiency in various microbial culture techniques for bacterial and fungal identification.  11 Iv Interpretation of colony characteristics on different media.  To different media.  To different media.  Proficiency in various microbial culture techniques for bacterial and fungal identification.  7														
TIV Interpretation of colony characteristics on different media.  Streak platting)  microbial culture techniques for bacterial and fungal identification.  To different media.  To different media.	II			ng, <b>5</b>	Proficie	ncy ii	ı var	ious						
selective media and enriched media.  IV Interpretation of colony characteristics on different media.  Typical selective media and enriched media.		streak pl	atting)		microbia	al cul	ture							
IV Interpretation of colony characteristics on different media.  Fivaluation of growth parameters:	III			a, 5						4,	5			
different media.	selective				and rung	gai iu	enun	ican	on.					
Evaluation of growth parameters:	IV			7										
Temperature, PH, nutrients.	V		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					

SEMESTER – IV											
Cour	se Title		English for Emplo					1	1	1	
Cour	se code	1 731182117778 1	Total credits: 2	L	_	P 2	S	R	O/F	C	
Duo n	oguisito.	Nil	Total hours: 32	<u>0</u>	0	2	0 Ni	0	0	2	
	equisite ramme		Co-requising the contract of Science in the contract of the co		TX7		INI	<u> </u>			
Seme			emester of second			omr	20				
Seme	Sici	1. To develop public speak						ınde	retand	inα	
	ourse ectives	nonverbal cues, overcomir  2. To provide practical exper cover letters.  3. To teach email etiquette, techniques.  4. To prepare students for integrated and mock interview session.  5. To introduce conflict management	including the structure the structure of	ing speaking submitting, a submitting, a submitting acture of emarketice with contactions are submitted.	strate and s ails a	egies cree and	ning effect y asl	gress	umes a e draft questic	and	
	201	Enable students to prepare	scripts, understand	d nonverbal	cues,	, ov	erco	me	fear, a	and	
	CO1	practice public speaking stra									
(	CO2	Equip students with skills to	prepare, submit, ar	nd screen resu	ımes	and	cov	er le	etters.		
	CO3	Teach students the different									
	CO4 CO5	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, and analyze its effects.									
Unit		Content	Contact	Learni	ing C	Outc	ome	!	K	KL .	
No.			Hour								
I	i. Prepa Nonv ii. Unde Publ	Speaking Skills ration of Scripts and understand verbal cues of Public Speaking erstanding and Overcoming Fea- ic Speaking ice strategies of Public Speakin	nr of	g effective speaking scripts, interpret nonverbal cues,						, 4	
II	letter i. Prepa Resur	ical session on cover letter scre	of	Students will and evaluate cover letters	resu				,	3	
III	i. Diffe	Etiquettes erent Parts of Email and Usage ting emails effectively	5	Students will structure of them effecti	emai	ls ar			2.	, 3	
IV	i. Prepa Quest	w Skills (Mock sessions) ring Commonly asked Interview ions k Interview sessions	7 w	Students will interview qu confidently in mock inte	esticand p	ons perfo				, 5	
V	i. Defin ii. Type	t Management ition of Conflict Management cts of Conflict Management	8	Students will concept of comanagement different typits effects.	onfli t, ide	ct ntify	7		2.	, 4	

- 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 A	cclimatizin	g Skills	(BA	S)				
Cours	se Code	22UULS201R	Total Credits Total Hours:		L 0	T 0	P 2	S 0	R 0	O/F 0	<b>C</b> 2
Pre-re	equisite	Nil	Co-rec	quisite		•	•	Nil	•		
Progr	amme	Bachelor of Science in Microbiology									
Semes	ster	Spring/	IV semester o	of second ye	ear of th	ne Pr	ogra	mme			
	ourse jectives	applications.  2. Students will be about	applications.  2. Students will be able to familiarize with the cooking equipment & Utensils.								
(	C <b>O</b> 1	Students will have basic	c knowledge of	f cooking m	ethods.						
(	CO2 Students will gain the knowledge o				Cleani	ng of	Roo	ms.			
(	CO3	Students will be able to	gain the travel	l manageme	ent conc	ept.					
(	C <b>O</b> 4	Students will be able to to-day use.	Students will be able to acquire the knowledge of basic household's amenities for day-								
Unit No.		Content	Content Contact Learning Outcome Hour						KL		
I	Introduction to Accommodation  Management  Telephone handling technique Organizing of Rooms. Cleaning agents. Cleaning equipment's and uses. Bed making Process.  Develop the ability to telephonic communic organize rooms, utilized cleaning agents and equipment effectively perform bed-making processes.					unica utilizand nd ively	ation, e		3, 4		
II	• ] • (	nentals of Cooking Definition of cookery –A Objectives of cooking. Use of basic cooking equ Personal Hygiene and Sat 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	• ] • 1 • 1	s of Cooking Different Cuts. Use of Herbs and Spices. Basic Food and Beverage  ☐ Regional food Habits.	Preparation.	7	Acquire knowledge of food preparation techniques, different cuts, herbs and spices, and regional food habits.						2, 3
IV	• ( • ] • ]	& Format's C –form Reservation form Registration form Passport Application forn Legal Rent Agreement	n	8	Gain p comple essenti reserva forms, docum agreem applica	eting al for ation: C-for ents l	and ums softenders some some some some some some some som	indersuch a s, reg and le	s istrati 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

		SEMESTER – IV								
Cours	se Title			Digital Li					0.75	T ~
Cours	se code	22UUDL101R	Total credits: 1 Total hours: 30	$\frac{\mathbf{L}}{0}$	T 0	P 2	S 0	R	0/F 0	C 2
Pre-re	equisite	Nil	Co-requisite				Nil			
Progr	amme	Bachelor of Science in Microbiology								
Semes	ster	•	ring/ IV semester of							
	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 Ha	rdware,	Softv	vare ai	nd Con	nputer
C	202	Students will be a Products.	ble to solve basic in	formation	manaş	gement	issues	s using	g MS-0	Office
C	<b>CO3</b>	Students will be at	ole to efficiently search	the Inter	rnet fo	r requii	ed inf	ormat	ion.	
C	<b>CO4</b>	for day-to-day use								
C	<b>CO5</b>		knowledge of digital and using various pay			n and a	cquire	pract	tical sk	tills in
Unit No.		Content		Contact Hour		Learnii	ng Ou	tcome	•	KL
I	i. Comp function ii. Diffe	onents of a Computons.	of Computer Systems of a Computer and their oes of Computers and their oes of Computers and their  7 Students will understant components and function computers and explored different types of compand their applications.						ns of	3, 4
II	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	MS-V and I docu and s	ents wi Office to Word, I MS-Exo ments, spreads	tools, in MS-Poster, to present the heets.	nclud owerPo create ntation	ing oint,	3
i. Introduction to Internet & Cyber V i. Introduction to Computer Net and Internet. ii. World Wide Web, Websites a portals, Web browsing. ii. Web Searching, Search engin Introduction to Google Search Engine; How to search using Keywords, topics of Interest, iii. Creation and use of Email Act iv. Cyber Crimes.			vebsites and Web ng. ch engines, de Search ch using Interest, etc. Email Accounts.	5	Students will acquire knowledge about computer networks, the internet, web browsing, search engines, and email creation, while understanding cybercrimes.					2, 3
IV	iv. Cyber Crimes.  Introduction to Social Media  i. The Power of social media, Relevance of social media in present scenario.			7	Stude power social accor		3, 5			

	ii. Creating accounts and using some popular social media portals and Apps like WhatsApp, Facebook, Twitter, Instagram, LinkedIn. iii. Social Media Etiquettes.		media platforms, and learn proper social media etiquette.	
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 accounts.	2, 3

- 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	STER – IV									
Cour	se Title		Forensio	Biology	ÿ							
Cour	se code	23FSFS401R	otal credits: .		L	T	P	S	R	O/F	C	
		To	otal hours: 4		3	0	0	0	0	0	3	
Pre-r	equisite	Nil	Co-requis	site				N	il			
Progr	ramme	Bachelo	or of Science	in Micr	obio	logy	•					
Seme	ester		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>									l its	
(	CO1	Acquire a foundational understan	nding of fore	nsic biol	ogy.							
	CO2	Learn the principles and technique	ues of DNA a	analysis.							-	
(	C <b>O</b> 3	Explore the analysis of bodily fluids, with a focus on bloodstain pattern analysis and the identification of blood group antigens.										
(	CO4	Investigate the role of entomolog		1 01				•	_			
(	C <b>O</b> 5	Understand the protocols and analyzing biological evidence from			in	coll	ectii	ng, p	oresei	rving,	and	
Unit		Content	Cont							KL		
No.	<b>.</b>	# + F + P + O	Hou									
I	of forens historica	ction to Forensic Biology: Overvice biology: scope, applications, and development, legal aspects and considerations in forensic biology		6 Understand basics of forensic biology						1,2		
II	DNA str forensic	es and Techniques of DNA Analucture and function relevant to applications, Techniques in DNA n, quantification, amplification (Pysis						incip g usin			1,2	
III	character saliva), t	s of Bodily Fluids: Identification a rization of bodily fluids (blood, se bloodstain pattern analysis: princip, and interpretation	emen,	de in	etecti	on a	and	echar		of	1,2	
IV	group sy techniqu	roup Antigens and Serology: Bl stems and their forensic significant es for blood group antigen testing cal analysis	nce,		Describe techniques for blood group detection.						1,2	
V	Role of A Investig identification profiling estimation biologica	age		iscus nthro			ic			1,2		

- **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	l – IV										
Course Title Basics of Food Science  Total Credits: 3 L T P S R O/F														
Cour	se code	23FSFN401R		L	T	ГР	S	R	O/F		C			
			Total Hours: 45	3	0	0	0	0	0		3			
	equisite	Nil	Co-requisite					[il						
	ramme		Bachelor of S											
Seme	ster	Spi	Spring/ IV semester of second year of the Programme											
	ourse jectives	2. Learn the fund	ndational understand lamental principles o emical reactions that	f food p	roce	essing te	chniq	ies.		ge.				
CO1		Acquire a founda	Acquire a foundational understanding of the basic components of food.											
(	CO2	Learn the fundamental principles of food processing techniques.												
(	CO3	Explore the chemical reactions that occur during food processing and storage.												
(	CO4	Examine the basics of food microbiology.												
(	CO5		Gain insights into sensory evaluation techniques used to assess the tatexture, and appearance of food products.							aro	ma,			
Unit		Content	arance of food produ	Contac	ct	Lea	rning	Outco	ome	F	KL			
No.		00110110		Hour			B		J	_				
Ι	Introdu	iction to Food Scie	nce: Overview of	6		Learn b	asics	of food	1					
	food sci	ence and its importa	ance, basic			science				1	1,2			
	compon	ents of food: carbol	ydrates, proteins,											
	lipids, v	ritamins, minerals, v	vater.											
II	Food P	rocessing Techniqu	ies: principles and	6		Unders	tand b	asic fo	od					
	methods	s of food preservation	on (e.g., heat			processing techniques					1,2			
	processi	ing, drying, freezing	), techniques for											
	food pa	ckaging and storage												
III	Chemic	cal Reactions in Fo	od Processing and	8		Explair	chem	ical ch	nanges					
	Storage	e: Chemical changes	during cooking,			during	food p	rocess	ing and	1	1,2			
	baking,	fermentation, and a	ging, factors			storage								
	influenc	cing chemical reaction	ons: pH,											
	tempera	iture, enzymes												
IV		<b>licrobiology</b> : Introd		8		Unders	tand m	icrobi	al					
	foodbor	rne pathogens and sp	ooilage organisms,			change	s durir	ıg		1	1,2			
	microbi	al growth kinetics a	nd factors affecting			fermen								
		al growth in foods												
V	_	y Evaluation of Foo		8		Explair	_	_						
	_	evaluation: taste, ar				sensory		1	1,2					
		nce, methods and te	chniques for			for qua	lity ass	sessme	ent.					
	sensory	evaluation	-											

- **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	741 887 7718	Total Credit Total Hours	_	L 0	T 0	P 0	<b>S 4</b>	<b>R</b> 0	O/F 0	<b>C</b>		
Pre-r	equisite	Nil	Co-req	uisite				Ni	l	I.			
Progr	ramme	Bachelor of Science in Microbiology											
Seme	ster	Spring/ IV ser	mester of sec	ond year of t	he l	Pro	grai	nme	2				
		1. To ascertain physical ar	nd mental de	velopment of	the	stu	ıden	ts ar	nd se	elect b	est		
Co	ourse	performers for state, nat	ional and inte	rnational leve	el co	omp	etiti	on.					
Obje	ectives	2. To enhance and improve	ve student's ta	alents in the f	field	d of	spo	orts,	yog	a, mu	sic,		
		dance, drama, etc. throu	dance, drama, etc. through AdtU club activities and workshops.										
	101	Enhance Leadership Skil	Enhance Leadership Skills-Students will develop leadership abilities through										
	CO1	various activities.											
	0.2	Improve Social Interaction-Students will learn to interact and build relationships											
C	<b>O2</b>	with others.											
	0.2	Develop Personal Interests and Hobbies- Students will explore and develop their											
	O3	personal interests and hobbies.											
~ .		Strengthen Problem-Solvi	Strengthen Problem-Solving Skills- Students will improve their ability to solve										
C	O4	problems creatively and ef	ffectively.										
	0.5	Foster Cultural Awarene	ess- Students	will gain a	be	tter	un	ders	tand	ing a	nd		
	O5	appreciation of different c	ultures.										
Unit		Content	Contact	Learn	ning	g Ot	ıtco	me		K	L		
No.	D 1		Hour										
I		n the learner's interest they icipate in various sports,	60	By participa sports, musi-	_				10*		,2		
	_	and co-curricular activities		activities off					urai	-			
		the clubs of the University		university cl				_	/ill				
		ll, Futsal; Cricket; Swimmin	g;	develop									
		all; Badminton; Table Tenni		physical and									
		and other outdoor and indo	or	leadership, teamwork, and									
		Dance; Music; Vocals;		creativity.	. 1		41						
		aphy; Drama; Literary s); The students are		They will en									
		ged to participate in regular		_	_		-						
		ivities, workshops,		knowledge through workshops with renowned professionals,									
		tions as per their interest and	1	and build self-confidence while									
		; Renowned skilled		fostering personal growth.									
	-	onals/ personalities are invite		These activi									
		ng workshops to promote the	e	cultural awa									
	talents of	of the students.		and lifelong learning,									
				encouraging students to pursue their interests, develop new									
				skills, and co			_						
				that extend b			•		-				
				academic jo	_								

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						

	SEMESTER – V												
Cours	se Title	Me	dical Bacte	eriology an	d Virolo	gy							
Cour	se code	23BSMB311R	Total cred			LI		S	R	O/F	C		
				rs: 45T+60	)P	3 0	4	0	0	0	5		
	equisite	Nil		-requisite				N	Vil				
	ramme		chelor of S										
Seme	ster	Fall/V se	emester of	third year	of the Pr	ogra	mm	e					
	ourse ectives	<ol> <li>To familiarize the studer and prevention and cont</li> <li>To teach different diagn</li> </ol>	rol measure	es of the dis	seases		·			& vir	uses		
(	CO1	Describe the types and chara	acteristics o	of normal ar	nd transie	nt flo	ora o	f hur	nan	body.			
C	CO2	Compare different virulence pathogenesis.	e factors of	viral and	bacterial _j	patho	ogen	s and	d the	eir role	in		
C	<b>CO3</b>	Explain Common Bacterial	xplain Common Bacterial Pathogens and Strategies for Prevention and Control										
C	CO4	Apply different staining and biochemical test for diagnosis of bacterial disease.											
		Explain Viral Pathogens and Effective Disease Management Strategies.											
	CO5	Explain virai Pathogens and	LHECUVE		ınagemen	ısır	ategi	es.		<u> </u>			
Unit No.		Content		Contact Hour	Lear	ning	g Ou	tcon	1e	ŀ	<b>KL</b>		
I	Benefic	ial Microbial Interactions with	h Human:	6	Describ	e an	d exp	olain	the	1	,2		
	Normal upper re	microbial population - Skin, espiratory tract, intestinal tract		normal microbial inhabitants of human body									
III	genital tract, eye.				Describe, illustrate and explain the microbial virulence factors and pathogenicity  Describe, illustrate and								
111	pathoge systems mode of prophyl diseases Streptod influenz Escheri Helicob	explain the different bacterial diseases, their causative agents, symptoms, of transmission, pathogenicity, nylaxis and control of the following ses. Staphylococcus aureus tococcus pyogenes, Haemophilus enzae, Mycobacterium tuberculosis, erichia coli, Salmonella, Vibrio cholerae, robacter pylori, Bacillus anthracis,							eir 1,		,2		
IV	Staining in diagr technique metaching Biocher Coagula carbohy gelatine	Clostridium, Treponema pallidum  Staining techniques and biochemical test used in diagnosis of pathogens – Staining techniques: Endospore, cell wall, flagella, metachromatic granules, hanging drop.  Biochemical tests: IMViC, Catalase, Coagulase, Oxidase, TSI, fermentation of carbohydrates, starch hydrolysis, urease, gelatine liquefaction, Use of selective media for specific bacteria  Describe, illustrate an explain the principle a process of different diagnostic tests for identification of a bacterial pathogen								1	,2		

V	Basic	Virology: – General properties,	10	Describe, illustrate and	1,2
	Morp	hology, Epidemiology, pathogenesis-		explain the different viral	
	patho	logy- diagnostics procedure - clinical		diseases, their causative	
		festation - prevention and control		organisms, mode of	
	measu	ures of- HIV, Pox virus, Influenza virus,		transmission, pathogenesis,	
		es virus, Polio Virus, Hepatitis Virus,		prophylaxis.	
		ps, Measles, Rubella, Arbovirus			
		tudy of normal micro-biota of mouth;	60	Proficiency in various	1,2,3,4
		olation, identification and preservation		diagnostic tests for	
		f microorganisms		bacterial and fungal	
		tudy of normal micro-biota of skin;		identification.	
		olation identification and preservation			
		f microorganisms			
		taining – Capsular staining by negative			
		aining, endospore staining,			
[E		etachromatic granules, motility, fungal			
Practical		aining			
rac		iochemical tests: IMViC, Catalase,			
Ь		oagulase, Oxidase, TSI, fermentation of			
		arbohydrates, starch hydrolysis, urease,			
	_	elatine liquefaction			
	5. Us	se of selective media for specific			
		acteria			
		ntibiotic Sensitivity test			
		lethods of isolation and identification of			
		ingi from Human Body: Staining			
	m	ethods- 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			Mycology	and Par							
Cou	rse code	23BSMB312R	Total cre		200	L	T	P	S	R	O/F	C
Pro-	requisite	Nil		urs: 45T+. o-requisite	-	3	0	2	0 Nil	0	0	4
	ramme	1411		of Science		robio	nlng	v	141	<u> </u>		
	ester	Fall/		er of third					me			
Sem	ester	1. To familiarize the s								func	ri and t	the
	ourse jectives	parasites.  2. To familiarize students about different diseases caused by fungi and parasites  3. To familiarize about the prevention and control measures of the diseases caused by fungi and parasites										
(	C <b>O1</b>	Comprehend the basic detecting and recovering	•				t fun	gi a	nd its	app	licatior	ı in
(	CO2	Enhance the knowled opportunistic infections laboratory diagnosis, tre	with resp eatment, a	ect to etiolond preventi	ogy, path ve measi	noge ures.	nesis	s, cli	nical	mani	festatio	ons,
(	CO3	Build foundation of the mycotoxins	ne structu	res and th	e pathog	genio	city	asso	ciate	d wit	h vari	ous.
(	CO4	Acquire proficiency in diagnosis of prevalent p			norpholog	gy, p	oatho	geni	icity,	and	laborat	tory
(	CO5		Developing skills in diagnosing in parasitic metazoan diseases through laboratory techniques and methods									
Unit No.		Content		Contact Hour	L	earı	ning	Out	come	9	K	KL
I	taxonom Detection clinical s	Introduction: Morphology of fungi of medical important and recovery of fungi functions. Yeasts of medice, dimorphic fungi	ortance.	10	Describ morpho medica the diag the clin	ology ally i gnos	y and mpo stic p	l tax rtant roce	onon fung dure	i and	1	,2
II	cutaneou etiology,	- superficial, sub cutane as, systemic and opportun pathogenesis, clinical ation, lab diagnosis, treat on	istic–	15	Describ the path manife treatme superfi cutaned opportu	hoge statient a cial, ous,	enesi on, l nd p sub syste	s, cli ab di rever cuta emic	nical lagno ntion neous	sis, of	n 1	,2
III	_	oxins- mycotoxins- struc l its pathogenicity	ture,	5	Describ the type disease	es of				•	n 1	,2
IV	lab diagr diseases- Trypano	ation, Morphology, Pathonosis of common protozonosis of common protozonosis. Amoebiasis, Giardiasis, somiasis, Malaria, Toxopniasis. Classification Monicity	an lasmosis,	10	Describ the type source infection morpho lab diag Flagell	es of of ir on, la ology gnos	f para nfectab di y, pa sis of	asite ion, agno thog Pro	s hos mode osis ar enesi tozoa	t, e of nd the s and	e	,2

V	Laboratory diagnosis of common parasitic	5	Describe, illustrate and explain	1,2				
	metazoan diseases- Ascariasis, Hook		the morphology, pathogenesis					
	worm, Filariasis, Taenia infection		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							
व	3. KOH mount, skin scrapping,							
tic	cultivation							
Practical	4. Preparation of Sabouraud's medium							
P ₁	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	F	Bio fertilizer	Productio	n							
Cours	se Code	23BSMB314R	Total Cre Total Hou		L	T	P	S	R	O/F	C	
Pre-re	equisite	Nil		equisite	0	0	2	0 N	<u>0</u> Vil	0	1	
	amme		Bachelor of		Microl	biolo	gy		111			
Semes		Fall/	V semester o					nme				
Course On successful completion of the course, the students will be able to Familiarize with the basic principle and techniques of Bio farming								rize				
Demonstrate proficiency in the isolation techniques for N2-fixing bacteria from var environmental samples, including soil and plant root nodules								rious				
C	Apply molecular and biochemical methods for the accurate identification classification of N2-fixing bacteria.							and				
C	<b>CO3</b>	Utilize selective media a from diverse soil and rhi		_	to isolat	e pho	sph	ate st	abiliz	zing ba	cteria	
C	CO4	Apply molecular and classification of AMF sp		cal method	s for the	he a	ccura	ate i	dentii	fication	and	
Unit No.		Content		Contact Hour	Le	earni	ng (	Outco	me		KL	
I	potentia Isolatio potentia bacteria the pote	Isolation, identification and analysis of the potentialities of N2 fixing bacteria, Isolation, identification and analysis of the potentialities of phosphate stabilizing bacteria, Isolation, identification and assess the potentialities of Arbuscular mycorrhizas fungi of rhizospheric soil			unders biofert	Students will be able to understand the process of biofertilizer production using microorganisms						

- **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 Conservation and Management									
Course code		23FSZO501R	Total credits: 3	г	L	T	P	S	R	O/F	C
Pre-requisite		Nil	Total hours: 457 Co-requisite		3	0	0	0 Ni	<u> </u>	0	3
Programme		1111	_		ionco i	n Micr	objol				
		Bachelor of Science in Microbiology									
Course Objectives		Fall/ V semester of third year of the Programme									
		<ol> <li>To understand the ecological principles that form the basis of wildlife conservation.</li> <li>To learn various techniques for assessing and monitoring wildlife biodiversity.</li> <li>To comprehend the significance of genetics in the conservation of wildlife species.</li> <li>To develop strategies for resolving conflicts between human activities and wildlife conservation.</li> <li>To gain knowledge of the legal and policy frameworks governing wildlife conservation.</li> </ol>									
(	CO1	Explain ecologic	cal principles that u	ınder	pin wil	dlife co	onserv	vation	efforts	s.	
(	C <b>O2</b>	Describe the techniques for assessing and monitoring wildlife biodiversity.									
(	CO3	Describe the role of genetics in wildlife conservation.									
(	C <b>O4</b>	Explain the strategies for mitigating conflicts between human activities and wildlife conservation goals.									
(	CO5	Describe the legal and policy frameworks that govern wildlife conservation									
Unit No.		Content			ntact Iour		me	KL			
I	Ecological Principles in Wildlife Conservation: Introduction to ecological principles, ecosystem functions, species interactions, population dynamics, habitat requirements, and landscape ecology.				10	Unde fund princ wild		1,2			
II	Techniques for Assessing and Monitoring Wildlife Biodiversity: Survey methods, population estimation techniques, biodiversity indices, remote sensing, and GIS in wildlife monitoring.				8	Abili vario biodi moni	1,2				
III	Role of Genetics in Wildlife Conservation: Genetic diversity, population genetics, conservation genetics, genetic drift, gene flow, inbreeding depression, and genetic management of small populations.				10	Undo impo wild	1,2				
IV	Mitigating Conflicts Between Human Activities and Wildlife Conservation: Human-wildlife conflict causes and impacts, conflict resolution strategies, community- based conservation, and sustainable development practices.				10	Abili strate betw wild	1,2				
V	Legal and Policy Frameworks in Wildlife Conservation: International conventions and agreements, national wildlife laws, protected area				7	polic	l and t vation.	1,2			

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	Toxicology									
Course Code		23FSFS501R	Total Credits: 3 Total Hours: 45T			T 0	P 0	S 0	R 0	O/F 0	C 3
Pre-requisite		Nil	Co-requis	site			•	Nil			•
Programme		Bachelor of Science in Microbiology									
Semes	ter	Fall/ V semester of third year of the Programme									
Course Objectives		<ol> <li>Explore the fundamental principles of toxicology, including the absorption, distribution, metabolism, and excretion (ADME) of toxic substances in living organisms.</li> <li>Acquire proficiency in analytical techniques used for the detection, quantification, and characterization of toxic substances in biological, environmental, and occupational samples.</li> </ol>									
(	C <b>O</b> 1	Explain the foundation of toxicological principles.									
(	CO2	Classify different types of toxicants.									
(	CO3	Assess the risk associated with exposure to toxic substances.									
CO4		Explain the mechanism of absorption, distribution, metabolism, and excretion of toxic substances within the body.									
CO5		Utilize toxicological knowledge to assess and manage risks in environmental and occupational settings.									
Unit No.		Content	Contact Hour		Lear	ŀ	KL				
I	<ul><li>Def toxi</li><li>Histori</li><li>Relation</li></ul>	ction to Toxicology: inition and scope of cology, tory and development of cological principles, ationship between dose and conse	10	Explain of toxico and devo definition and the and resp	ry ,	1,2					
II	Classific     Typ     biol     Sou     toxi     Tox	cation of Toxicants less of toxicants: Chemical, logical, and physical logical exposure routes of cants licokinetics and codynamics		Classify understa of expos principle dynamic	es	1,2					
III	<ul><li>Prin</li><li>Haz</li><li>chan</li><li>Dos</li><li>Exp</li><li>Risl</li></ul>	sessment and Management aciples of risk assessment and identification and racterization acterization assessment assessment assessment acceptable assessment acceptable acceptabl	nt 10	Assess t exposur applying assessm identific assessm and risk manager	e to to g prinent, i eationent, e ent, e char	oxic nciple nclue n, dos expos acter	substes of a ding l se-res	risk hazaro ponse issessi	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.	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					

	SEMESTER – V											
Course	Title	Rese	earch I (Review	of literati	ure)							
Course	Code	23BSMB316R	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	isite				Ni	l		•	
Program	nme		Bachelor of Sc	ience in M	licro	biolo	gy					
Semeste	er	Fall/	v semester of tl	hird year o	of the	e Pro	gran	ıme				
Cou Objec		<ol> <li>Apply experimental evaluation and for st</li> <li>Use relevant scientification</li> </ol>	atistical treatme	_		cient	ific 1	ask,	colle	ct data	a for	
CO	)1	Learn to tabulate research	h data									
CO	)2	Analyze research outcor	ne									
CO	)3	Correlate with existing l	iterature									
CO	)4	Prepare and effective dis	ssertation report									
CO	)5	Able to communicate re	search outcome									
Unit No.		Content		Contact Hour		Lea	rning	Out	come	;	KL	
I	search		30	rese met	earch thods earch	seare for s topic	ch en select c effe	nding gine a ing a ctivel	and ly	1,2,3		
II	II Tools for reference citation, Different methods for writing citation and references, Introduction to structure of Review and specific features of review, Plagiarism, ethnical issue in writing the review, Mapping and selection of Journal of specific knowledge of discipline and submission for publications.			30	stru cha rev awa and	racteriew arene	e and ristic and de ss of	uniques of a evelo plagi	n resea p iarism	arch	1,2,3	

# **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						
S.N.	Course Outcome (CO)	Mapped Program 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					

	SEMESTER – V												
Cours	se Title		Extra-Curr	icular Activ	ities								
Cours	se code	1 731   R H T ' 3 1 1 1 2 1	Total Credits		L	T	P	S	R	O/F	C		
		1	Total Hours:		0	0	0	4	0	0	1		
	equisite		Nil Co-requisite Nil										
	ramme	Bachelor of Science in Microbiology											
Seme	ster	Fall/ V semester of third year of the Programme											
	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	others.											
(	CO3	Develop Personal Interests and Hobbies- Students will explore and develop their personal interests and hobbies.											
(	CO4	Strengthen Problem-Solvin problems creatively and effectively	_	udents will	imp	rove	the	ir al	oility	to so	olve		
C	CO5	Foster Cultural Awareness- Students will gain a better understanding and appreciation of different cultures.											
Unit No.		Content	Contact Hour	Lea	arniı	ng C	utco	ome		1	KL		
I	participa and co-c clubs of Futsal; C Basketba athletics games; I Photogra activities encourage club active competite hobbies; profession organisis	the learner's interest they can the in various sports, music, curricular 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 ing workshops to promote the f the students.		By participal music, and offered throstudents will physical and leadership, creativity. They will emanagement knowledge with renow build self-confostering peractivities proposed activities propursue their skills, and context extend beyong journey.	co-co-co-co-co-co-co-co-co-co-co-co-co-c	univelo univel	cular versi p agilik, ar ime racti worl essic e wh rowt ultur ty, a ng sti s, de pass	activity cluity, cal	ops and nese felon ts to new that	50	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 – VI											
Cours	se Title		Fern	nentation '	Technology	7						
Cours	se code	23BSMB321R		redits: 4 ours: 45T	+30P	1 3	T 0	P 2	S 0	R	O/F 0	<u>C</u>
Pre-re	equisite	Nil		Co-requisi				N	il			
Progr	amme	В	Bachelor of Science in Microbiology									
Semes	ster	Spring/ V	I semest	er of third	year of the	e Pr	ogr	amr	ne			
	ourse ectives	fermentation processe	<ol> <li>The objective of this paper is to familiarize the students with the concept of fermentation processes &amp; the use of different microorganisms in industries.</li> <li>To teach the students about the different industrial products produced by</li> </ol>									
(	CO1	Understand bioreactors as in diverse bioprocessing s			es, enabling	the	m to	ap _l	oly tl	his k	nowle	edge
C	CO2	Understand different typinformed decisions in bio				en	npov	weri	ng t	hem	to m	ake
C	203	Students will be well ver Processes and with the va						•	•			e up
C	CO4	Students will be well versed with the screening techniques, Microbial assays, Primary & Secondary metabolites.										
C	CO5	Understand the production	n process	of differer	nt types of fe	erm	enta	ation	pro	duct		
Unit No.		Content		Contact Hour	Lear	nin	ıg O	utc	ome		K	KL
I	Configurates, ba	of a basic fermenter, biorea tration, design features, indi- affles, impellers, foam separ culture vessel, cooling and	vidual ators,	5	Describe and explain the structure and different parts of fermenter					.,2		
II	batch, c importa	of cultures in the fermenter ontinuous and fed batch, nce of media in fermentatio ormulation and modification	n,	5	Describe, i explain the fermentation formulation fermentation	e di on j on o	ffer proc	ent t	ype' es an		1	.,2
III Biomass separation by centrifugation, filtration, flocculation and other recent developments. Cell disintegration, extraction, purification by different methods, drying and crystallization			8	Describe, i explain the of biomass disintegrat	e di s se	ffer para	ent 1	neth			.,2	
IV Isolation, selection and improvement of microbial cultures: Screening and isolation of microorganisms, Primary and secondary metabolites, preservation of cultures after strain improvement programme Immobilization of cells and enzymes-Principle, Method of mobilization and its applications				10	Describe, i explain the of isolation of industri microorga process of	e di n ar ally nisr	fferend point in interest in i	ent rese port and t	neth rvati ant he	on		,,2

V	Production of pharmaceuticals: Antibiotics (penicillin), hormones (humulin), vaccines (Hepatitis B), Vitamin B12, Production of organic acids: Acetic Acid, Citric Acid, Lactic Acid, Production of Amino acids: Lysine, Glutamic Acid, Production of Enzymes: Protease, Amylase Production of Fuels: Ethanol, Methanol, Mushroom Cultivation and Wine production	17	Describe, illustrate and explain the different products produced by microorganisms by fermentation.	1,2
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					

	SEMESTER – VI											
Cours	se Title	In	dustrial and Total Credi		utical M	licro L	obio T	logy P	$\mathbf{S}$	R	O/F	С
Cours	se code	23BSMB322R	Total Hours		P	3	0	2	0	0	0	4
Pre-re	equisite	Nil	Co-	-requisite					N	il		
Progr	amme		Bachelor of	f Science ir	Microb	iolo	ogy					
Semes	ster		/ VI semeste									
	ourse ectives	<ol> <li>To incorporate a strong understanding and in-depth knowledge of pharmaceutical microbiology principles, techniques, processes</li> <li>Study the strategies in order to avoid any potentially costly and life-threatening failures and consequences.</li> </ol>										
C	CO1	Understand basic pharm classification, and rec actions, therapeutic effe	ognize the p	orimary asp	ects of	pha	ırma	cod				
C	O2	Comprehend the funda metabolism, interaction	_			veri	ng a	abso	rptic	on, di	istribu	tion,
C	203	Understand the princip (GMP) in the pharmace			_	Goo	od N	Aanı	ıfact	uring	g Prac	tices
C	O4	Attain proficiency in que contamination control, services, and cleaning p	encompassin		•	•				•		
C	205	Acquire expertise in to quality control, incorporate	•	_	_						_	
Unit No.		Content		Contact Hour	Le	arn	ing	Out	com	ie	]	KL
I	sources	ction to pharmacology: Dotton to pharmacology: Dotton, terminology used, class codynamics— Actions, Tle, toxic	ification,	9	Describ Pharma							1,2
II	metabo	cokinetics— absorption, d lism, interaction, excretion administration, Storage of	on, Routes	9	Describ explain of drug storage	the s an	Pha	ırma	coki	netic		1,2
III	pharma Applica Quality GMP Q	es and applications of Glecuticals and cosmetics Factions and Definitions The The regulatory factors Quality assurance beyond practices in cosmetic m	Principles— e concept of QC, QA and GMP ISO,	9	Describ explain drug ma assuran	qua anu	ality factu	aspo aring	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  Describe, illustrate and explain about quality management aspect of premises, Personnel Hygiene, documentation and regulatory.							1,2					
V		cal aspects for pharmacer c Products, Quality contr		9	Describ explain							1,2

	GCLP Sterile and other products. Validation Cosmetics microbiology-testing methods and preservation antimicrobial preservation efficacy and microbial content testing,		non-sterile pharmaceutical products, efficacy and evaluation of preservatives use in pharmaceuticals and	
	Validation method for cosmetics Preservation strategy, Evaluation of		cosmetics	
	antimicrobial mechanism			
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					

	SEMESTER – VI											
Course	e Title		Mushro	om Cultiv	ation							
Course	e Code	23BSMB323R		tal Credits: 1 tal Hours:30		<b>L</b> 0	T 0	P 2	S 0	R 0	O/F 0	C 1
Pre-re	quisite	Nil	Co	-requisite					Ni	l	u u	
Progra	amme	В	achelor of	Science i	n Micro	obio	logy					
Semes	ter	Fall/ V	semester o	of third ye	ar of th	ne P	rogr	amn	1e			
Course Objectives		<ol> <li>To create awareness about the Mushroom among the people.</li> <li>To strengthen the promotion of mushroom cultivation by establishing a well-equipped laboratory and offices.</li> <li>To know and explore the cultivation in Assam</li> </ol>										
(	CO1	Explain different classes of mushroom.										
(	CO2	Understand reproduction and growth of mushroom.										
(	CO3	Explain mushroom spawn production										
(	CO4	Discuss the methods of o	cultivation	of mushro	room							
(	CO5	Explain the techniques for	or the utiliz	zation of n	nushroo	m sp	ent					
Unit No.		Content		Contact Hour	L	earı	ning	Out	come	9	K	KL
I	Setting of laboratory for mushroom cultivation; preparation and production of mother culture, mother and commercial spawn; preparation and cultivation of mushroom; mushroom spent management by vermicomposting.		30	The st cultiva					to	1,2	2,3,4	

# **REFERENCE BOOKS:**

- 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	Course Title Herbal Medicine										
Cours	se Code	23FSBO601R	Total Cro			L I		S	R	O/F	C
				<u>urs: 45T</u>		3 0	0	0	0	0	3
	equisite	Nil		Co-requisi	1			N	<u>il</u>		
Programme Bachelor of Science in Microbiology											
Semes	ster	Spring/	VI semest	er of third	year of the	Prog	ram	me			
		To understand the pharmacological properties of medicinal plants.									
Course		2. To learn the methods of formulation of herbal medicine.									
	jectives	3. To evaluate scientific literature on herbal medicine.									
	jeeuves	4. To discuss the clin									
		5. To comprehend th	e legal and	ethical issu	ies related to	herb	al me	edici	ne.		
	CO1	Discuss pharmacologic	cal properti	es of medic	cinal plants.						
	CO2	Explain the methods o	f formulatio	on of herba	l medicine.						
	CO3	Evaluate scientific lite	rature on he	erbal medic	cine.						
	CO4	Discuss clinical applic	ations of he	erbal medic	cine.						
	CO5	Understand the legal a	nd ethical is	ssues on he	erbal medici	ne.					
Unit		Content		Contact	Lear	rning	Outo	come	2	1	KL
No.	70.	1 1 15 4 15		Hour	D 11						1.2
I		ological Properties of M		9	Describe the pharmacological properties and mechanisms of					1,2	
		troduction to pharmacog compounds in plants, me		action of b							
		examples of commonly		in medicin			mpc	unu	3		
	medicinal			in modernia primes							
II		of Formulation of Herb	9	Demonstrate knowledge of different extraction and				2	2,3		
		: Extraction methods, pro									
		s, formulation techniques		formulation techniques used in herbal medicine.			n				
		decoctions, infusions, ta standardization of herba		nerbai med	ncine	•					
	products.	standardization of neroa									
III		on of Scientific Literatu	re on	9	Critically 6	cally evaluate and interpret					4,5
	Herbal M	Iedicine:			scientific 1						
		methodologies, critical a			herbal med	dicine					
		studies, systematic revie									
IV		yses, interpretation of res	suits.	9	Discuss the	o olin	i o o 1				3,4
1 1	Medicine	Applications of Herbal		9	application			and			0,4
		· rbal medicine in treating	common		efficacy of		•		nes i	n	
ailments, safety and		evidence-based applicati			treating va						
		l efficacy, interaction wit	h								
conventional medicines.											
V	_	d Ethical Issues in Herb	al	9	Understand						1,2
	Medicine	: ry frameworks, quality co	ontrol		legal and e to the prac						
		al property rights, ethical			herbal med			scar	711 OI		
		tions in research and practions			increase interest		•				
	patient co	_	• 								

- 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

# **REFERENCE BOOKS:**

- 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	trition L	I — I —	1 ~ 1	_		1~
Course code		23FSFD601R	Total Credits: 3 Total Hours: 45T			T P 0 0	<b>S 0</b>	R 0	O/F 0	<b>C</b> 3
Pre-re	equisite	Nil	Co-r	equisite			Nil			
Progr	amme		Bachelor of So	cience in M	<b>Aicrobiolog</b>	y				
Semes	ster	Spring	/ VI semester o	f third yea	r of the Pro	ogramn	ne			
		1. To understand the pri	nciples and prac	ctices of nu	tritional epi	demiol	ogy.			
		2. To assess the nutritio	2. To assess the nutritional needs of communities.							
	urse ectives	3. To implement and ev								
Obje	ctives	4. To understand the ro	le of advocacy a	and policy	developmen	nt in im	provin	g co	mmu	nity
		nutrition.								
		5. To develop strategies					tion pi	ogra	ms.	
	01	Explain the principles a			_					
	02	Assess community nutr				l metho	dologi	es.		
	03	Implement and evaluate Understand and apply				to im	nrove	con	mun	itx
C	<b>O4</b>	nutrition.	advocacy and	i policy d	ievelopinem	to III	prove	COII	mun	пту
C	O5	Develop and implemen	t effective nutri	tion educat	ion and inte	rventio	n prog	rams		
Unit		Content		Contact	Learn	ing Ou	tcom	e	K	(L
No.	<b>37</b>			Hour	T 1 1 1	•		1		
I		onal Epidemiology inciples of nutritional epi	damiology	9	Explain the practices of			ınd	1	,2
		udy designs in nutritional			epidemiol		lonai			
		easurement of dietary inta			r	-6,1				
			n nutritional							
		idemiology		9	A			.: 4:	2	. 2
II		unity Nutrition Needs A ethods of assessing comn		9	Assess co needs usir				2	.,3
		trition needs	latifity		tools and		•			
	• Di	ietary surveys and nutritional status								
		sessments								
		e of anthropometry, biochemical, and nical data								
		terpretation of nutrition d	ata							
III	Comm	unity Nutrition Progran	ns	9	Implemen			e	3	,4
		anning and implementing	nutrition		communit	•	ion			
	•	ograms onitoring and evaluation	of nutrition		programs.					
		ograms	or numeron							
		ase studies of successful c	ommunity							
		trition programs	. •.•							
Challenges in implementing nutrition programs										
IV Advocacy and Policy Development		9	Understan	d the sig	gnifica	ince	3	,4		
	<ul> <li>Role of advocacy in community nutrition</li> </ul>			of advocac	y in pro	motir				
		olicy development process			community					
		trategies for influencing nutrition policy Case studies of nutrition advocacy and			innitiatives steps invol					
policy change effective										
V	Nutriti	on Education and	Intervention	9	Understand	d the co	re		4	-,5
	Progra		tion		principal g					
	• Prii	nciples of nutrition educa	поп		nutrition e					
				l	and gain si	MIIIS IU (	acsigii	anu		

•	Developing and implementing nutrition	implement nutrition	
	education programs	education programs.	
•	Behaviour changes communication		
	strategies		
•	Evaluating the effectiveness of nutrition		
	interventions		

- 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 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 15th and 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

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 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: 137

# 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.

# **Breakdown of Credits**

Sl.	Category		<b>Total number of</b>
No			Credits
1		Skill Enhancement Course (SEC)	4
		Ability Enhancement Course(AEC)	8
	University Core(UC)	Field Training	0
		Discipline Specific Elective (DSE)	0
		Value Added Course (VAC)	7
2	University Elective (UE)	Multidisciplinary Course (MDC)	2
	Offiversity Elective (OE)	Value Added Course (VAC)	0
3		Discipline Specific Core(DSC)	68
	Program Core(PC)	Field Training	3
	Trogram Corc(TC)	Research /Industry Internship	9
		Summer Internship	3
4	Program Elective (PE)	Discipline Specific Elective (DSE)	27
	1 Togram Elective (TE)	Value Added Course (VAC)	2
5	Faculty Core(FC)	Skill Enhancement Course (SEC)	4
	racuity Core(IC)	Ability Enhancement Course(AEC)	0
		137	

# **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	128	93.43%
2	Engineering	4	2.92%
3	Commerce and Management	5	3.65%
	Total	137	100%

# SEMESTER WISE COURSE DISTRIBUTION

	Sl.	Course		Course		En	ıgaş	gen	nen	t		Max	imum N for	Tarks	
	No.	Code	Course Title	Category	L	T	P	S	R	o	C	IA*	SEE*	PE*	Total
	1.	23BSBT111R	Cell biology	DSC-Major	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSBT112R	General Microbiology	DSC-Major	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSBT113R	Biomolecules	DSC-Major	3	0	2	0	0	0	4	40	60	100	200
	4.	23UBPD112R	Elementary English	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester I	5.	23BSBT114R	Field-based Learning and Community Services	Field Training	0	0	0	0	0	4	1	0	0	100	100
	6.	23BSCE111R	MOOCS-I	DSE	0	0	0	0	0	0	1	0	0	100	100
	7.	23UBEC111	Extra-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	8	23UBCC111	Co-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
			DSC Minor (Su	ıb Disciplinaı	ry)	(Aı	ny (	one	to	be	selecto	ed)			
	9.	23FSCH101R	Basic Chemistry	DSC-Minor	2	0	0	0	0	0	2	40	60	0	100
	10.	23FSZO102R	Animal Science	DSC-Minor	2	0	0	0	0	0	2	40	60	0	100
		To	otal								19				1200

	Sl.	Course	Community of	Course		En	ıgaş	gen	nen	t		Max	imum N for	<b>Aarks</b>	
	No.	Code	Course Title	Category	L	T	P	S	R	O	С	IA*	SEE*	PE*	Total
	1.	23BSBT121R	Enzymes and Metabolism	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSBT122R	Genetics	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	3.	23BSBT123R	Bioinstrumentation	DSC Major	3	0	2	0	0	0	4	40	60	100	200
ter II	4.	23UBPD113R	Implicative English (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester II	5.	23BES101R	Environmental Science	MDC	2	0	0	0	0	0	2	40	60	0	100
	6.	23BSCE112R	MOOCS-II	DSE	0	0	0	0	0	0	1	0	0	100	100
	7.	23BSBT124R	Field-based Learning and Community Services	Field Training	0	0	0	0	0	8	1	0	0	100	100
	8.	23UBEC111	Extra-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	9	23UBCC111	Co-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
		To	otal								19				1200

	Sl.	Carries Cada	Course Tide	Course	]	Eng	gag	em	en	t			laximi Iarks :		
	No.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSBT211R	Immunology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSBT212R	Molecular Biology	DSC Major	3	0	4	0	0	0	5	40	60	100	200
	3.	23BSBT213R	Genetic engineering	DSC Major	3	0	4	0	0	0	5	40	60	100	100
	4.	23UBPD213R	Proficient communication (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
er III	5.	23BSBT214R	Techno Professional Course I	SEC	0	0	2	0	0	0	1	0	0	100	100
Semester III	6.	23BSBT215R	Field-based Learning and Community Services	Field Training	0	0	0	0	0	4	1	0	0	100	100
	7.	23BSCE113R	MOOCS-III	DSE	0	0	0	0	0	0	1	0	0	100	100
	8.	23UBCC211	Co-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	9.	23UBEC211	Extra-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	10.	23UULS202R	Basic Life Saving Skills	SEC	0	0	2	0	0	0	1	0	0	100	100
	11.	23UUFL202R	Personal Financial Planning	SEC	0	0	2	0	0	0	1	0	0	100	100
	12.	23BSBT216R	MOOCS(GE)-I	DSE	0	0	0	0	0	0	1	0	0	100	100
		1	DSC Minor (Su	b Disciplinar	<b>y</b> )	(Aı	ny	one	e to	be	select	ted)			•
	13.	23FSZO301R	Entomology	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
	14.	23FSBO301R	Forestry	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
		Tot	al								26				1500

	Sl. No.	Course Code	Course Title	Course		E	ng	ag	em	ent		Maxi	mum M for	1arks	
	110.			Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSBT221R	Food Biotechnology	DSC Major	3	0	4	0	0	0	5	40	60	100	200
	2.	23BSBT222R	Developmental biology	DSC Major	2	0	0	0	0	0	2	40	60	100	200
	3.	23BSBT223R	Bioinformatics	DSC Major	2	0	2	0	0	0	3	40	60	100	200
	4.	23BSBT224R	Biophysical chemistry	DSC Major	3	0	0	0	0	0	3	40	60	100	200
_	5.	23UBPD223R	Campus to Corporate (PDP)	AEC	0	0	4	0	0	0	2	0	0	100	100
Semester IV	6.	23BSBT225R	Techno professional Course II	SEC	0	0	0	4	0	0	1	0	0	100	100
Se	7.	23UULS202R	Basic Acclimatizing Skills	SEC	0	0	0	2	0	0	1	0	0	100	100
	8.	23UCDL101R	Digital Literacy	SEC	0	0	0	2	0	0	1	0	0	100	100
	9.	23BSBT226R	MOOCS(GE)-II	DSE	0	0	0	0	0	0	1	0	0	100	100
	10.	23UBCC211	Co-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	11.	23UBEC211	Extra-Curricular	VAC	0	0	0	0	0	0	0.5	0	0	100	100
	12.	23BSBT227R	Indian Heritage (Swayam)	VAC	0	0	0	0	0	0	1	0	0	100	100
			DSC Minor (Su	b Disciplinar	ry)	(A	ny	or	ie t	o be	e sele	cted)			
	13.	23FSFD401R	Basics of food Science	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
	14.	23FSFS401R	Forensic Biology	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
		Tot	tal								24				1700

	Sl.	Course		Course	I	Ξn	ga	ge	me	nt		Maxi	mum M for	1arks	
	No.	Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSBT311R	Plant biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSBT312R	Medical biotechnology	DSC Major	3	0	4	0	0	0	5	40	60	100	200
	3.	23BSBT313R	Research methodology/statistical analysis	Research	2	0	0	0	0	0	2	0	0	100	100
	4.	23BSBT314R	Mini research	Research	0	0	0	0	8	0	2	0	0	100	100
Semester V	5.	23BSBT315R	Techno Professional course III	SEC	0	0	2	0	0	0	1	0	0	100	100
Sem	6.	23BSBT316R	Summer Internship	Summer Internship	0	0	0	0	0	0	3	0	0	100	100
	7.	23BSCE114R	MOOCS-IV	DSE	0	0	0	0	0	0	1	0	0	100	100
	8.	23BSBT317R	MOOCS(GE)-III	DSE	0	0	0	0	0	0	1	0	0	100	100
	9.	23BSBT318R	The Age of Sustainable Development (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
			DSC Minor (Sub I	Disciplinary)	<b>(</b> A	۱n	y (	n	e to	be	sele	cted)			
	10.	23FSZO501R	Wild life conservation and Management	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
	11.	23FSFS501R	Toxicology	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
		,	<b>Total</b>								24				1200

	Sl. No.	Course	Course Title	Course		F	Eng	gag	em	ent		Maxi	mum N for	<b>Aarks</b>	
	110.	Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	23BSBT321R	Animal biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
	2.	23BSBT322R	Industrial biotechnology	DSC Major	3	0	2	0	0	0	4	40	60	100	200
Semester VI	3.	23BSBT323R	Techno professional skill course IV	SEC	0	0	2	0	0	0	1	0	0	100	100
ste	4.	23BSBT324R	Dissertation	Research	0	0	0	0	20	0	5	0	0	100	100
me	5.	23BSCE115R	MOOCS-V	DSE	0	0	0	0	0	0	2	0	0	100	100
Š	6.	23BSBT325R	MOOCS (GE)-III	DSE	0	0	0	0	0	0	2	0	0	100	100
	7.	23BSBT326R	AI in Healthcare Specialization (Coursera)	VAC	0	0	0	0	0	0	2	0	0	100	100
			DSC Minor (Sub	Disciplinar	y)	( <b>A</b>	ny	tw	o t	o be	e sele	cted)	•		
	8.	23FSBO601R	Herbal Medicine	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
	9.	23FSFD601R	Community Nutrition	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
	10.	23FSCH601R	Natural Product Chemistry	DSC Minor	3	0	0	0	0	0	3	40	60	0	100
		To	otal								25				1100
	,	Total for all si	x semesters								137				7900

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

		SEMESTE	R – I							
Course Ti	tle		ell Biolog	y						
Course co	de 23BSBT111R Total	credits: 4	L	T	P	S	R	O/F		С
	Total	hours: 45T+	-30P 3	0	2	0	0	0		4
Pre-requis		Co-requisite				Ni	il			
Programi		Bachelor of Sc								
Semeste		I semester of t								
Course										
Objective	-		_							l cell
	organelles, cell c			-	_				_	
	2. To inculcate know	-			_	echni	ques,	and u	ıdeı	rstand
	cell structure by ol	-		_				. 11		
	3. Gain proficiency	•	_			-				ology
601	research, including									
CO1	Understand cellular organi									
CO2	Describe membrane structi	ure, function, o	cell organi	ızatıon	and the	e prot	eins	involv	ed 11	n
003	transportation.	matrice at 1 to	• • • • • • • • • • • • • • • • • • • •							
CO3	Elaborate chromosomal str	• •								
CO4 CO5	Understand the mechanism					· C:	-11 4			
	Describe the cell cycle and	division in ge								T/T
Unit-No.	Content		Contact	]	Learni	ing C	utco	me		KL
T	Fundamentals of Call Dia	James (Call	Hour	Dana	:1	:11	~4~~4		.1	
I	Fundamentals of Cell Bio	•			ribe,		strate			
	theory, Prokaryote and Euk	•	7	_	in centions,	_		tion an		1.2
	Structure and Function of c and Technique of	, ·	7		tural di				a	1,2
	and Technique of (Microscopy and Staining).	Cytology:		Struc	iurai u	111616	nces.	•		
II	Cell Membranes: Model,	Structure,		Desc	ribe,	illu	strate	e an	d	
11	function; Cell junctions and	´			-			tructur		
	Transport proteins; Membras		10	1 -						1,2
	Membrane potential; Trans		10	function; can and the protection			_			1,2
	plasma membrane.	per deress			portation		1111			
III	Chromosomes: Morphology	(Structural		Desc			strate	e an	d	
	organization: nucleosome,	· ·		expla				nosoma		
	model, chromatid, centro		10	_	ture an					1,2
	telomere); Types (special type	e).				• •				
IV	Cell trafficking and sign	alling: cell		Desc	ribe,	illu	strate	e an	d	
	signals; signalling pathways;	cell surface	0	expla	in the	e me	echar	nism (	of	1.2
	receptors, protein phos	phorylation;	8	cell t	o cell o	comn	nunic	ation		1,2
	Quorum sensing phenomenon	1.								
V	Cell Division & Cell Cycle	: regulation,		Desc	ribe,	illu	strate	e an	d	
	growth and differentiation; (	Overview of	10	_			-	cle an		1,2
	Stem cells, Germ cells, C		10	divis	ion in	gen	eral	and i	n	1,2
	Apoptosis and Necrotic cell d				specif					
Practical	1. Staining and microscopic			Desc	- 1		strate			
	of various stages of Mito	sis of given						stainin		
	sample(s).		30		-			rry ou	ıt	1,2,
	2. Staining and microscopic		20	micro	oscopio	e exa	nina	tion.		3,4
	of various stages in Meio	osis of given								
	sample(s).									

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

			SEMEST										
Course	Title			eral N	Microbiol	ogy							
Course	code	23BSBT112R	Total credits: 4		L	T	P	S	R	O/F	C		
			Total hours: 45	T+30I	P 3	0	2	0	0	0	4		
Pre-req		Nil	Co-requisi					N	il				
Progra	mme		Bachelor of										
Semes	ster		Fall/ I semester of										
Cour			e history, concept		_	of n	nicro	organi	sms ir	the fiel	d of		
Object	tives		medical, agricultu										
		_	vledge and skills o			ment	ts and	l tech	niques	used for	r		
			re and identificatio										
CO	1	Describe fundamen	ntals of microbio	ology	and con	tribut	tions	made	e by	many 6	eminen		
CO		scientists.	• •	1.1 .		1							
CO		Describe and explai						•	· a	•			
CO		Apply the knowled	_	utocla	ive, hot ai	r ove	en, lai	mınar	air flo	ow, mici	roscope		
		and isolate microbe		- <b>C</b>									
CO		Explain the method				ms.							
CO:	Content				Contact Learning Outcome								
No.		Conte	ent	'	Hour		Lear	ning	Outco	me	KL		
I I	Func	lamentals of Mi	erobiology: Hist	orv	11001	Des	cribe	fun	damer	itals of			
1			0.	-			robio		uamen	and			
	(Contributions of A.V. Leeuwenhoek, Louis Pasteur, Koch Joseph Lister, and Alexander					tribut		mad					
	Flamming); Scope; Terms & Definition;			7				scient	•	1,2			
	Flamming); Scope; Terms & Definition; Importance of Microbiology; Branches of				11161	11) 011	11110111	501011					
	1 -	obiology.	eregy, Diamenes										
II		roscopy: Simple,	compound, ph	ase		Abl	le t	o d	escribe	e and			
		ast and electron mic	• •		10	exp	lain	micr	oscope	es and	1,2		
			•			_			and us				
III	Micr	obial Techniques:	Sterilization & fi	lter		Des	scribe	i, il	ustrate	e and			
	(Phy	sical methods: Aut	oclave, Hot air ov	en,		exp	lain	t	he	basic			
	Lami	nar airflow, Seitz	filter, Sintered gl	lass		nniqu	es	such	as				
	filter	, membrane filter;	Chemical Metho	ds:		ster	ilizat	ion,	stainin	g etc.,			
		hol, Aldehydes, Ph			10	use	d in	a m	crobic	ological	1,2		
		ous agents; Radia				stuc	dy.						
	Gam	• //											
	I	iples, Types (simp		ıns,									
T 7 7		fast and Differential		0			••	• • •		4			
IV	I	robial Taxonomy: (						*	ustrate				
		ns; classification o				_				ods of			
	Gran	rial cell (structure positive &		· ·	8			ation,		uctures	1 2		
		n positive & sification based of	•		o		terial		or a	typical	1,2		
		tion of microbes; I				Jac	wiidl	CCII					
		onment	THE COUCS OF CAUC	71110									
V		uring microbes:	Media & tvr	oes;		Des	scribe	. il	ustrate	e and	+		
•		tion and screening		rve;				-		reening			
		tenance and presen	•	1	10	and			aring	of	1 1.2		
	cultu	-	11115100					ganisn	_				
Practi		Laboratory Safety	, preparation	for			scribe		ustrate	e and	1,2,		
cal		experiment, and	laboratory was		30		lain		nd	apply	3,4		
	l	,	,			-r				117	- / -		

	management.	laboratory safety rules, set	
	Principle, operation and measurement of	a microbiological	
۷.	• •	· ·	
	pH of a given sample	experiment for microbial	
3.	Principle and operation of Hot air oven,	isolation, prepare slides by	
	Autoclave, Laminar airflow and	applying staining	
	centrifuge.	techniques and observe	
4.	Isolation of microbes from given sample	them under microscope.	
	by serial dilution techniques and		
	estimation of the CFU (Pour plate and		
	streak plate techniques also be learned)		
	Staining (gram, acid fast, endospore		
	or any appropriate staining) of the		
	given microbial sample and		
	observation under microscope.		

### **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 2
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

		SEMESTEI	R – I							
<b>Course Title</b>		Bio	-Molecule	S						
Course code	23BSBT112R	Total credits: 4	L	T P	S	R	)/F	C		
		Total hours: 45T+30	)P 3	0 2	0	0	0	4		
Pre-requisite	Nil	Co-requisite			Nil	<u> </u>				
Programme		Bachelor of Sc								
Semester		Fall/ I semester of f								
Course	_	knowledge and unders	_			ro-molecu	les o	of life,		
Objectives		their constitution, classification, structure and functions.								
		p skills for qualitative a	analysis of	these mo	lecules b	by biocher	nica	1		
	methods.									
CO1	_	omprehensive understanding of the structure, function and differentiation of the types						ypes of		
G0.	DNA and RNA						1 .1			
CO2	Demonstrate the structure and correlate its properties, biological importance and qualitative analytical tests for amino acid.						and the			
CO2	1			1.1 0	1 .	• .1				
CO3		us levels of protein org						1		
CO4		of carbohydrate in tern	ns of its str	ucture, c	ıassıtıcat	ion, prope	rties	and		
COF	the laboratory qua		-t G	4: 1	1:66	4:-4:	41 4			
CO5	Comprehensive un lipids	nderstanding of the stru	ciure, func	uon and	unteren	uauon of	ıne t	ypes of		
Unit-No.	-	Contact	Ιρο	rning O	utcome		KL			
omi ivo.		ontent	Hour	Let		utcome		IXL		
I	Nucleic acid: S	tructure (Nitrogenous	11041	Descri	be, illu	strate an	d			
-	bases, ribos	` •			· ·	ucture an				
	Nucleosides, nucleotides); glycosidic			_		cleic acio				
	and phospo	,		includi		differe				
		formation, single letter	4.0	forms.	υ					
	\ _ ·	Vatson-Crick Model;	10					1,2		
	forms [A,B,Z];	Physical Properties;								
	denaturation and	l renaturation); RNA								
	and its types; C	Clover leaf model of								
	tRNA.									
II	Amino acids	s: Classifications;		Descri	be, illu	strate an	d			
	Essential and	Non-Essential amino	5	explair	the str	ucture an	d	1,2		
	acids; Properties	s (physical, chemical	3	proper	ties of a	mino acio	.s	1,2		
	& optical); Impor			and cla	ssify the	m.				
III		ification based on			be, illu					
		proteins (keratins,		_		ucture an	d			
	_	tin), globular proteins		function	n of prot	eins.				
	(hemoglobin,	myoglobin),								
		metallo proteins,	10					1,2		
		nd nucleoproteins];						- ,-		
	1	position); Structure								
	•	ndary, tertiary &								
	1 2//	Denaturation and								
	renaturation; Fun									
IV	Carbohydrates:			Descri	*	strate an				
	Isomerism, (D	, ,	40	_		ucture an		1.2		
	· •	mers, Mutarotation;	10	tunctio	n ot carb	oohydrates	·	1,2		
		s (linear and cyclic).								
	Disaccharides (s	structure, occurrence,								

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,

- **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									
Cours	e Title		Basic	Chen	nistry	,				
Cours	e code	23FSCH101R	Total credits: 2	L	T	P	S	R	O/F	C
	• • •	<b>N</b> 701	Total hours: 30T	2	0	0	0	0	0	2
	quisite	Nil	Co-requisite	•	D: 4		Ni	il		
	amme		Bachelor of Scie							
	ester urse	1. To give the	Fall/ I semester of first year of the programme  1. To give the knowledge about Chemical Kinetics and Ionic Equilibrium							
	ctives		etailed description of at							o it
Obje	CHVCS	_	-					theorie	es related t	O It
			<ul><li>and the knowledge of classical and quantum chemistry.</li><li>To give the knowledge of the periodic properties and HSAB theory</li></ul>							
C	01	_	der of the rate law e		_				-	e" and
		temperature depend	lency of reaction rates u	sing t	he Ar	rhenius	equat	ion.		
CO	)2	Explain the concep	ots of electrochemistry,	, elect	troche	mical	cells,	acids/b	oase, pH,	ouffers
		and solubility								
CO	)3		tructure, Heisenberg U	ncerta	ainty	princip	ole, Qu	ıantum	n mechani	cs and
		Schrodinger wave e	*							
CC			pts of chemical bonding			_				
CO	J5	_	ent types of organic re	eaction	ıs alo	ng wit	n thei	r mec	hanisms, c	organic
Unit-		molecules and their Conte		Con	tact	T	aanni-	ng Out	teome	KL
No.		Conte	ciit	Ho		L	eariiii	ig Out	come	KL
I	Chem	ical Kinetics: Ord	ler-molecularity. First	110	, u i	Unde	rstand	u	ınderlying	
_			order rate equation,			conce		_	of	
		erature dependence of rate of reactions.			0	electrochemistry,				
					0	electr	ochem	ical	cells,	1,2
						acids/	base,	pH, bu	uffers and	
						solub				
II		•	trolytic conductance,				rstand		atomic	
		•	trolysis, Electrolytes,			struct			Ieisenberg	
		· · · · · · · · · · · · · · · · · · ·	theory for dissociation n constants of weak				rtainty	mecha	principle,	
		* *				-			nics and equation.	
		s and bases, pH, buffers, solubility products effects and solubility			3		_		graphical	1,2
	Suit Ci	rects and soldonity							different	
						_			d how the	
						electr	ons a	e fille	ed in the	
						orbita	1.			
III	Atom	ic Structure: Reca	pitulation of Bohr's			Unde	rstand	the co	oncepts of	
	-		ns, dual behaviour of					_	by using	
			deBroglie's relation,						periodic	
		-	principle. Need of a						comic and	
			ic structure. What is						on Energy	
	_	uantum mechanics, Time independent chrodinger equation and meaning of various			0			-	, Electro	
				1	U	_	ivity dic tab		ements of	1,2
	terms in it. Wave functions (atomic orbitals) at their variations for 1s, 2s, 2p, 3s, 3p and					berroo	iic tau	ic.		
			representation) Rules							
			in various orbitals,							
		•	of the atoms. Stability							
		•	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

- 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 '	Title		A	Animal S	cien	ce					
Course	code	23FSZO101R	Total credits: 2	L	T	P	S	R	O/F	C	
			Total hours: 30T	2	0	0	0	0	0	2	
Pre-requ	isite	Nil	Co-requisite				N	il			
Program	nme		Bachelor of So								
Semes	ter		Fall/ I semester of			_					
Cour		1. Analyze the diversity, structure, and classification of the animal kingdom,									
Object	ives	focusing on triploblastic coelomate organization.									
			life processes includ	_	regu	lation,	excre	tion, ne	ural condu	action,	
			endocrine regulation, and reproduction.  3. Examine the relationships between insects and microbes, and explore integrated								
			-	een insec	ts an	id mic	robes,	and ex	xplore inte	grated	
			ement strategies.	1 4	1	1::	4		_4: :	14:	
		_	e principles of ev				ıy, an	a gen	etics, inc	luaing	
COI	Mendelian and non-Mendelia  CO1 Identify and classify species of anima				e pai	terns.					
CO1			chemical processes of		in liv	ing ha	ina				
CO ₂			te phenomena of anin								
CO3		*	on process, importan								
COS			enetics of living orga		uivei	SILY III	oispoi				
Unit-	<u>'</u>	Conten		Contact	.	T a	<b>:</b>	- O4a		1/1	
No.		Conten	ıı	Hour		Le	arminş	g Outco	ome	KL	
I I	Dive	rsity of Ani	mal Kingdom:	Hour	De	escribe	illust	rate an	d evnlain		
1		loblastic coeloma			Describe, illustrate and explain the basic concepts associated						
		nals with mantle:			with each system of the body						
	Anin			in vertebrates and							
		nodermata, Phylur			verteb						
	Phyl	•		_				ures th	at are in		
		hordata, Subphylum	1 7	5	place in the body systems to					1 1 /	
		olylum Vertebrata	-		_	rform		ne .	functions		
	_	atha, Class Cyclosto	omata, Superclass:		according to the habits or						
	Gnat	hostomata, Class Pi	sces (Cartilaginous		ha	bitats	of the	animal	s.		
	and	bony fish), Class	Amphibia, Class								
	Rept	ilia, Class Aves, Cla	ss Mammalia								
II	Life	processes Concepts	of osmoregulation		De	escribe	e, illus	trate ar	nd explain		
	and	excretion, Categori	zation of animals				_		ferent life		
		the basis of prin	-		•				regulation		
		etory products.				_	roduct	ive bi	ology of		
		ation of urea, d			an	imal.					
		xification.Control a									
		bility, Structure									
	_	ns - human eye and		6						1,2	
		e impulse: Resting	_								
	_	potential and refractory period. Synaptic									
		mission, Endocr	0								
		nones as chemi	· ·								
	feedl		•								
		etogenesis, structu									
	_	n of mammal. Fe									
vitro	fertilization, ovipar	ny, viviparity and									

	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: <a href="https://microbenotes.com/">https://microbenotes.com/</a>

	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					

		51	EMESTER	- ı						
<b>Course Title</b>			Eleme		Engli	ish				
Course code	23UBPD113R	Total cred	its: 2	L	T	P	S	R	O/F	С
		Total hour	rs: 60P	0	0	4	0	0	0	2
Pre-requisite	Nil	Co-rec	quisite				N	il		
Programme			helor of Sci							
Semester			mester of fi							
Course	_	nize and i	dentify par	ts of	a ser	ntence	and t	heir si	gnificance	in a
Objectives	language.									
		<ol> <li>To enhance listening and speaking/skills for self-development.</li> <li>To give insight into English pronunciation and into central concepts in</li> </ol>								
		•	o English	pron	uncıat	ion an	d inte	o cent	ral conce	pts in
	phonetics	ion to the va	ملامس ميرمنس	a of o	O 400 400 1	miaatia		an han	aa thain	
		ge of commu		S OI C	ommu	micano	n wiii	ennan	ce meir	
CO1	Equip students to re			of spee	ech ar	ticles at	nd auv	iliary ve	erhs and to	create
	both affirmative and	d negative se	ntences.	_						
CO2	Teach students to a	pply determi	ners, form di	fferen	t types	of sent	ences,	and co	mprehend d	legrees
CO3	of comparison. Prepare students to	confidently	introduce the	emselv	/es 115	e nrone	r nroni	ınciatio	n intonatio	n and
	stress, and effective	ly ask for an	d provide inf	ormat	ion.		_			
	Help students gras									
	manage both for communication.	mal and in	itormal con	ımunı	cation,	and	ıdentıt	y barri	iers to ef	tective
	Teach students the	key compo	nents of an	effect	ive pro	esentatio	on and	how t	o use visu	al aids
	proficiently.									1
Unit-No.		Content			tact	L	earnii	ıg Out	come	KL
I	Basics of C	Grammar	(Flipped	п	our	Stude	nto svi	11 dem	onstrate a	
1	classroom)	ji aiiiiiai	(Filppeu						erstanding	
	i. Parts of Speed	eh				of gra			8	1,2,
	ii. Articles			(	6					3
	iii. Auxiliary Ve iv. Affirmativ		Magativa							
	iv. Affirmative Sentences	ve and	Negative							
II	Grammar (Flip	ped classro	oom)			Stude	nts	will	construct	
	i. Determiners	-	•			_		•	rrect and	
	ii. Sentence Cor		A		6	varied	l sente	nce typ	es.	1,2,
	iii. Types of S Imperative, etc.		Assertive,							3,4
	iv. Degree of Co									
III	Speaking Skills	S							onfidently	
	i. Introduction a	and Greeting			_	introd			lves and	1.2.
	ii. Pronunciation				5	engag		in	basic	1,2,
	mi. Asking and o	riering info	manon						n correct	
IV	Communicatio	n Skills				Stude			ffectively	
	i. Introduction to					comm		te i	n both	
	ii. Process			forma		and	informal			
	Communication, iii. Formal and informal				7	setting	gs.			1,2,
	communication		mormal							3
	iv. Understan		rriers to							
				1						1
IV	i. Introduction to ii. Process	n Skills o Communi and Ty				Studer comm forma	nciation nts valunica 1 a	on. will e		

#### **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

SEMESTER – I										
<b>Course Title</b>			Curricula	r Act	ivities					
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-requisite	Nil	Co-requisite		D.		Ni	11			
Programme										
Semester Course	1 To aggorite	Fall/ I semester of first year of the programme								
Objectives		1. To ascertain physical and mental development of the students and select best performers for state, national and international level competition.								
Objectives	_					_		oga music		
		dance, drama, etc through AdtU club activities and workshops.								
CO1		•								
CO2			•							
CO3										
CO4		_								
CO5										
Unit-	Conte	nt	Contac	t	Lea	arning	Outco	ome	KL	
No.		Hour								
part co-c of Cric Bad othe Mus Lite ence acti thei skil invi	r Fall/ I semester  1. To ascertain physical and r performers for state, national 2. To enhance and improve students.		60	action divided and action action and action action and action ac	ross sprricular verse owth. amwork eativity otball, usical ster ordinate mmuninking. Illed plustry entorshe paring allenge rticipated herture dividua ademicuipped da bro	orts, norts, norts, norts, norts, norts, norts, norts, skills Stuck, leading the throughout cricked pursus self-exition, wort cation worth worth words. Beginning to the skills ally with badened diversity skills and the skills ally with badened diversity skills.	nusic, a vities and dents adersh ugh sp t, and its ar apressi hile lit ities and kshops sionals nsights opp ents f y en used or , un wel who and practi d persp	athletics.  ad dance on and terary and enhance critical led by provide	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:**

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

	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						
Title		Co-Cu	rricula	r Acti	vities				
code	23UBEC111	Total credits: 1	L	T	P	S	R	O/F	C
		Total hours: 60P	0	0	0	4	0	0	1
uisite	Nil	Co-requisite					il		
nme									
ter									
se				_					et best
ives	-					-			
	2. To enhance and improve student's talents in the field of sports, yoga, music,								
							_		
							ter.		
							ally.		
5									1
	Conte	nt			L	earning	g Outo	ome	KL
		• 1	Hou	r	1	C1 '11	ъ	1 .	
					1.			_	
							_		
_								annwork,	
•		_						tion, and	
comm	unities and play	y a crucial role in							
					2.			Growth:	
are	_	_				Suppo	orting		
							onal,	social,	
	1								
							_		
3.		Clubs and				_		academic	
1		Sarvice and	60		3		_	letworks:	1,2
4.	•	Scrvice and			5.		_	ictworks.	
5.	_	and Personal					_	es to	
٥.		and Tersonal							
6.	-	d Hobby-based						and	
	Activities	,					-	ls.	
					4.	Perso	nal		
							_		
								•	
֓֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜	Co-currange compleare ty within commindisticare  1. 2. 3. 4. 5.	risite Nil mme ter se 1. To ascert ives performer 2. To enhan dance, dr. Students will lear Students will lear Students will imp Students will becomplement academia are typically organiz within educational communities and play holistic development are  1. Sports and Phy 2. Cultural Activ 3. Academic Competitions 4. Community Volunteering 5. Leadership Development 6. Creative an	Title Code 23UBEC111 Total credits: 1 Total hours: 60P  nisite Nil Co-requisite  Bachelor of Ster Fall/ I semester of See 1. To ascertain physical and men performers for state, national a 2. To enhance and improve stude dance, drama, etc through Adtil Students will learn to work well with o Students will learn to manage their tim Students will enhance their creative about Students will improve their overall hear Students will become more aware of the Content  Co-curricular activities cover a wide range of experiences and pursuits that complement academic learning. They are typically organized and managed within educational institutions or communities and play a crucial role in holistic development. Some examples are  1. Sports and Physical Activities 2. Cultural Activities: 2. Cultural Activities: 3. Academic Clubs and Competitions 4. Community Service and Volunteering 5. Leadership and Personal Development 6. Creative and Hobby-based	Code   23UBEC111   Total credits: 1   Total hours: 60P   Total hours	Title   Co-Curricular Activities   Code   23UBEC111   Total credits: 1   Total hours: 60P   0   0   0   0   0   0   0   0   0	Title   Co-Curricular Activities   Code   23UBEC111   Total credits: 1   Total hours: 60P   0   0   0   0   0   0   0   0   0	Title Code 23UBEC111   Total credits: 1	Title   Co-Curricular Activities   Co-Curricular Activities   Co-Curricular Activities   Co-Curricular Activities   Co-Curricular Activities   Co-Curricular Activities   Nil   Co-requisite   Nil   Co-requisite   Nil   Bachelor of Science in Biotechnology   Item   Fall/ I semester of first year of the programme   See   1. To ascertain physical and mental development of the students performers for state, national and international level competition   2. To enhance and improve student's talents in the field of sports, dance, drama, etc through AdtU club activities and workshops.   Students will learn to work well with others and communicate better.   Students will learn to manage their time and stay organized.   Students will improve their overall health and reduce stress.   Students will become more aware of their role in society and contribute   Content   Content	Title   Co-Curricular Activities   Co-Curricular Activities   Code   23UBEC111   Total credits: 1   L   T   P   S   R   O/F   Total hours: 60P   0   0   0   4   0   0    Insite   Nil   Co-requisite   Nil   Sachelor of Science in Biotechnology   Insite   Nil   Co-requisite   Sachelor of Science in Biotechnology   Insite   Nil   Co-requisite   Sachelor of Science in Biotechnology   Insite   Total credits: 1   L   T   P   S   R   O/F   Insite   Nil   Co-requisite   Nil   Insite   Nil   Co-requisite   Nil   Insite   Bachelor of Science in Biotechnology   Insite   Sachelor of Science in Biotechnology   Insite   Nil   Co-requisite   Stide through Adit   Competition   Insite   Total credits: 1   Competition   Insite   Nil   Co-requisite   Stidents will learn to manage their through and international level competition   Insite   Competition   Competition   Insite   Nil   Co-requisite   Students will learn to manage their through and order through and workshops   Insite   Nil   Competition   Insite   Nil   Co-requisite   Students will learn to manage their through additional dance, drama, etc through AdtU club activities and workshops   Insite   Nil   Competition   I

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	tle	Enzymes a	nd Metak	olism				
Course co	de 23BSBT121R	Total credits: 4	L	ГР	S	R	O/F	C
		Total hours: 45T+30P	3	0 2	0	0	0	4
Pre-requis	ite Nil	Co-requisite			N	Vil		
Programn	ne	Bachelor of Scie						
Semester		Fall/ II semester of fir						
Course		udents understand about of	-					
Objective		ins, their role in regulatin	-				energy	by
	T	protein metabolisms and	-	_	-			
	_	s for quantitative estimati	on of DN	A, RNA	, prote	ins and	carbo	hydrates
	and extraction							
CO1	•	s, enzyme kinetics, includ						
CO2	and mine	rals and	d their	contrib	ution f	or overal		
	I =	opment of the human bod						
CO3		ration of cellular energy	in our boo	ly throu	igh reg	ulation	of cart	oohydrate
	metabolism.							1:00
CO4		erconnection between pr	rotein me	tabolisn	n in o	ur bod	y and	differen
005	associated metabo	1 .	41	1 - 4	1 1	.4	41 1	
CO5		ological effects of plant	growth reg	gulators	in plai	nt grow	tn and	
Unit-No.	development	ntont	Contact	La		Outoo		KL
Umit-ivo.	Co	ontent	Hour	Lea	arming	Outco	me	KL
I	Fnzyme: History	Terminology, General	Hour	Able	to	desi	cribe,	
•	characteristics	Classification,			in an		strate	
		zyme; cofactor; active		the		mes	and	
		lechanism OF action			ne kin			
	-	el; Induced fit model),	15					1,2
	`	(Michaelis- Menten						
	equation, Line weav	ver Burk plot), Enzyme						
	(inhibition, specifici	ty, Application).						
II	Vitamins and I	Minerals: Definition;		Able	to	explain	the	
	Types; Functions;	classification; sources;	10	types	_	urces	and	1,2
	deficiency		10			of vita	mins	1,2
	Disorder.				nineral			
III	1	tabolism: Glycolysis,				explain		
		ruvate, TCA cycle,		illust		he pat	•	
		ogen, gluconeogenesis,	10	for		carbohy		1,2
	1 1	pathway, glyoxylate			bolism		the	
		drial electron transport,		enzyı	nes inv	volved.		
IV	oxidative phosphory  Protein Metaboli			A 1, 1 .	to	xxx1a:	a. 1	
1 V	proteins, Oxidativ	•				explain he pat		
	· ·	carboxylation of amino	10			netabol	-	1,2
	acids, Urea Cy	*	10	and	the		ymes	1,2
	formation.	or and Croaminic		invol		CIIZ	<i>,</i> 111 <b>0</b> 5	
V		regulators- Auxins,				derstan	d the	
•		nins. Abscisic acid and				h regul		
		nthesis- Structure of	15	_	_	nctions		1,2
	photosynthetic app			also		olain	and	
	1 J 3PP	, ==		1	11			

	pathways, Light and Dark reaction, <b>Nitrogen metabolism</b> and fixation of nitrogen in leguminous plants.		illustrate CO2 and N2 Fixation.	
Practical	<ol> <li>Quantitative estimation of Proteins (Lowry's method).</li> <li>DNA (Diphenylamine method),</li> <li>RNA (Orcinol method),</li> <li>Amino acids (Ninhydrin reaction),</li> <li>sugars (Dinitrosalicylic acid method)</li> <li>Extraction of Protein from milk</li> </ol>	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	1 – II								
Course Title			Genet	ics							
Course code	23BSBT122R	Total credits: 4		L	T	P	S	R	O/F		C
<b>D</b>	N101	Total hours: 45T+3	0P	3	0	2	0	0	0		4
Pre-requisite	Nil	Co-requisite		. D.	4 1		Nil				
Programme		Bachelor of Sc									
Semester Course	1. To famili	Fall/ II semester of arize with concepts of						and th	10 00n	tini	uina
Objectives		f evolution because of	_	_							_
Objectives	mutation		pheno	mone	ni sucii	as IIII	Kage	and c	103311	g 0	v C1 ,
		skills through hands o	n prac	tice f	or some	e of the	e obse	ervati	onal s	ud	ies
	_	ryotyping and barr boo	_								
CO1		e of genetic material a			's laws	of in	herita	ance a	and ca	use	es of
	variations.										
CO2	Explain the gen	etic mechanism of	sex d	etern	nination	and	dyn	amic	struc	ture	e of
	chromosomes.										
CO3	1	etic mechanism crossi	ng ov	er th	at resul	lts rec	ombi	natio	n and	gei	netic
604	basis blood group		1 1	-4:-:	41	1. C	1	4-1			1:1
CO4		tic material exchange injugation, and transdu		cteria	throug	gn Tune	dame	ntai p	proces	ses	like
CO5		nechanisms of mutation		gene	tic stahi	ility ar	nd dix	ercita	in a		
603	population.	icenamsms of mutation	is and	gene	iic stabi	iiity ai	iu ui v	cisity	ma		
Unit-No.		ontent	Con	tact	Lea	arning	Out	come		K	
			Но			···	,				
I	Fundamentals	of Genetics: Scope;			Able	to d	escril	oe, a	nd		
		as genetic material,			_	in gen			ial		
	,	& RNA); Mendel's			and it	s impl	icatio	ons			
	,	nce, Segregation &	1:	5						1.	,2
	_	sortment); Concepts									
	,	tropy, Test cross, ninance, Back cross									
	and problems)	illiance, back closs									
II		ination: (Plants,			Devel	lop u	nders	standi	ng		
		nans, Drosophila);				x deter					
	Chromosome,	Autosomes;	10	`						1	2
	Allosomes; Se	x linked genes &	10	)						1,	,2
	dosage compen	sation of X- linked									
	genes.										
III	_	Crossing Over:				to	_		the		
		epulsion hypothesis; aize, drosophila);			linked	a g nbinati	genes		nd		
	`	ver (mechanism,				ossing					
		romosome mapping,				n evoli			110		
		apping, physical	10	)						1.	,2
		gene interaction								7	
	(supplementary	factors,									
	complementary	-									
	_	is, allelism), blood									
	groups in humar	1.									

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 –	II							
Cours	se Title		Bioinstrumen								
	se code	23BSBT123R	Total credits: 4	L	T	P	S	R	O/F	С	
			Total hours: 45T+30P		0	2	0	0	0	4	
Pre-re	quisite	Nil	Co-requisite				Nil				
	amme		Bachelor of Scien	ce in B	iotec	hnolog	<b>E</b> Y				
	ester		Fall/ II semester of firs				•	;			
Cor	urse	1. To make the stud									
Obje	ctives	1. To make the students understand about the principle, types and applications of instruments such as chromatography, centrifugation, gel-electrophoresis, blotting,									
· ·		radioisotopes and s	pectroscopy.				-				
		2. To develop skills	s on operations of chroma	tograph	ıy, ce	entrifug	ation, g	gel-ele	ctropho	resis	
		and spectroscopic a	nalysis.		-				-		
C	01		chromatographic technic	ques ar	nd th	neir hi	story,	princi	ples, w	orkin	
			cations in various fields.	•			•		•		
C	<b>D2</b>	* * **	ion, its principles, and its	diverse	app	lication	ıs.				
	03	1	techniques used in n					iques	such	as ge	
		1 -	measurement, dialysis, a			3)		•		8-	
C	<del>04</del>		iple, application of radio			ng and	mech	anism	of radio	oactiv	
Ο,		decay.	1 7 Trr-Tourish of Tudio	P C	1	-5					
C	05	•	ng principle of various spe	ectrosco	pic r	nethod	s and th	neir an	plicatio	ns in	
			ntration and molecular str		r				r		
Unit-		Cont		Cont	act	Le	arning	Outco	ome	KL	
No.				Hou							
I	Chron	natography: Histor	y; Classification; Types,			Descri	ibe, illu	strate	and		
	1		pplication & analysis			explai	n pH, b	uffers	and		
	1	-	tion column, Partition,	1.5		_	l theori			1.0	
	1	ayer, Ion exchange, quantitative Ion		15						1,2	
	exchar	nge, and Gel	-								
	Chrom	natography):									
II	Centr	ifugation: Types; A	pplication; Principle;			Descri	ibe, illu	strate	and		
	rotors	; density gradient &	analytical	10		explain quantum				1,2	
	centri	fugation.				10		mechanics and the lav	laws	1,2	
						associ	ated wi	th it.			
III	Gel	<b>Electrophoresis:</b>	Application; Types;				ibe and	_			
	1 -		ciple); Dialysis, <b>Blotting</b>	10			ent bon	_		1,2	
	techni	que: Southern, Wes	stern, & Northern blot				for int	eractio	on of a	1,2	
						molec					
IV			echnique: Introduction,				ibe, illu				
			arement of radioactivity,	10		_	n the la			1,2	
		-	on, units, radioactive			therm	odynaı	nics		1,2	
	decay.										
$\mathbf{V}$	1 1	•	iniques: Introduction,				ibe, illu				
	Princip	ple and application of	of spectroscopy	15		_	n the m		ism of	1,2	
						protein	n foldir	ng			
Prac	Operat	tion of molecules fro	om given sample by			Able t	o use v	arious			
tical	_	er chromatography				instrui	ments f	or ana	lysis		
	2. Coli	umn chromatograph	у	20						1.2	
	3. Thir	n layer chromatogra	phy	30						1,2	
		-	protein molecules by								
	_	ectrophoresis	-								
				·						1	

- **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	R – II					
Course	Title	IMPLICATIVE	ENGLISH (Commun	icative E	Engli	ish & Soft	Skills)		
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		
Progra	mme		Bachelor of So	ience in	Bio	technolog	у		
Semes	ster		Fall/ II semester of	first yea	r of	the progr	amme		
Cour	rse	1. To introduce the	e types of sentences ar	d their si	igni	ficance.			
Object	tives	2. To strengthen th	ne vocabulary of the st	udents to	enl	nance stude	nt' vocal	bulary to	
		enhance their							
		speaking and writi	ing skills it the importa	nce of d	ress	codes in v	arious or	ganisations	<b>5.</b>
		3. To introduce the	e 3P's (Planning, prior	itizing &	z pei	forming) o	f Time N	Ianagemen	ıt.
CO	1	Provide students wit	th the ability to transform	n sentence	e typ	es, utilize di	fferent ter	nses, and ad	dress
		common grammatic	al mistakes.						
CO	2	_	o proficiently apply one-						-
		_	oid frequently confused	words, ar	nd in	corporate ic	ioms and	phrases in t	heir
60		vocabulary.	1 1' 1 '		1	01:			1
CO	3		omprehending the various to effective listening.	s aspects a	and 1	types of liste	ening, and	in identifyi	ng and
CO	1		n employing effective re	adina etra	tegi	es extractin	a relevant	information	n from
	4	texts, and utilizing the		ading stra	uegn	cs, extractin	g reievani	miormation	ii iioiii
CO	5	Instruct students on	the significance of time	managei	ment	and provid	e foundat	ional strates	gies to
		manage their time ef	fficiently.	1 C :	1	T ' 1 1T	C1		
CO	6		ating a well-rounded and	i professio	onai		ome.		
TT		~ .		~ .		-	• •		TZT
Unit-		Conte	ent	Contac		Lear	ning Out	come	KL
No.	C			Contac Hour					KL
		ımar (flipped classr	oom)			Students	will	accurately	KL
No.	i. Inte	nmar (flipped classr	room) tive and Assertive	Hour		Students construct a	will nd transfo		1,2,
No.	i. Inte Sente	nmar (flipped classr erchange of Interroga nces, Exclamatory ar	oom)			Students construct a	will nd transfo types an	accurately orm various	
No.	i. Inte Sente ii. Ty	nmar (flipped classr	room) tive and Assertive	Hour		Students construct a sentence	will nd transfo types an	accurately orm various	1,2,
No.	i. Inte Sente ii. Tyj iii. Co	nmar (flipped classr erchange of Interroga nces, Exclamatory ar pes of Tenses	room) tive and Assertive and Assertive Sentences	Hour		Students construct a sentence grammatics	will nd transfo types an al errors.	accurately orm various	1,2,
No.	i. Inte Sente ii. Ty iii. Co Voca i. O	nmar (flipped classr erchange of Interroga nces, Exclamatory ar pes of Tenses ommon Errors bulary Developmen one word substitution	tive and Assertive and Assertive Sentences	Hour 6		Students construct a sentence grammatical Students vocabulary	will nd transfo types an al errors. will enha	accurately orm various and correct ance their use words	1,2,
No.	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H	nmar (flipped classrenchange of Interrogances, Exclamatory are pes of Tenses ommon Errors bulary Developmentone word substitution fomonyms and Homo	tive and Assertive and Assertive Sentences	Hour		Students construct a sentence grammatical	will nd transfo types an al errors. will enha	accurately orm various and correct ance their use words	1,2,
No.	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H iii. W	nmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Developmenter word substitution formonyms and Homo Vords often confused	tive and Assertive and Assertive Sentences	Hour 6		Students construct a sentence grammatical Students vocabulary	will nd transfo types an al errors. will enha	accurately orm various and correct ance their use words	1,2,
No.	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H iii. W iv. Id	nmar (flipped classrenchange of Interrogances, Exclamatory ar pes of Tenses ommon Errors  bulary Developmenton word substitution from only mand Homo Vords often confused blioms and phrases ning Skills	tive and Assertive and Assertive Sentences	Hour 6		Students construct a sentence grammatic:  Students vocabulary accurately  Students	will nd transfo types an al errors. will enha and u in context	accurately orm various and correct ance their use words	1,2, 3
No. I	i. Interest Sente ii. Tyliii. Color Voca ii. O ii. H iii. W iv. Id Lister i. What iii. What iii. What iii. What iiii. What iiii. What iiii. What iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	nmar (flipped classrenchange of Interrogances, Exclamatory are pes of Tenses ommon Errors bulary Developmentone word substitution from the word substitution for only often confused the still s	tive and Assertive and Assertive Sentences	6 6		Students construct a sentence grammatics:  Students vocabulary accurately  Students effective	will nd transfo types an al errors. will enha and u in context will d istening	accurately orm various and correct ance their use words	1,2, 3
No. I	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H iii. W iv. Io Liste i. Wha ii. Typ	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Development of the word substitution for the word substitution for the word of the confused flioms and phrases on the substitution of the substitution of the word of the confused flioms and phrases on the substitution of the substitution of the word of the	tive and Assertive and Assertive Sentences  t  pphones	Hour 6		Students construct a sentence grammatic:  Students vocabulary accurately  Students	will nd transfo types an al errors. will enha and u in context will d istening	accurately orm various and correct ance their use words	1,2, 3
No. I	i. Inte Sente ii. Tyj iii. Co ii. O iii. H iii. W iv. Io Lister i.Wha ii.Typ iii. U	nmar (flipped classrenchange of Interrogances, Exclamatory argument of Tenses ommon Errors  bulary Development of the word substitution for only me word of the confused dioms and phrases oning Skills at its listening?	tive and Assertive and Assertive Sentences  t  pphones	6 6		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify lis	will nd transfo types an al errors. will enha and u in context will d istening tening bar	accurately orm various and correct ance their use words	1,2, 3 1,2, 3
No. I	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H iii. W iv. Id Liste i.Wha ii. Typ iii. Un	mmar (flipped classrenchange of Interrogances, Exclamatory are pes of Tenses ommon Errors bulary Developmentone word substitution omonyms and Home Vords often confused dioms and phrases ming Skills at is listening?	tive and Assertive and Assertive Sentences  t  pphones	6 6		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify lis	will nd transfo types an al errors. will enha and u in context will d istening tening bar	accurately orm various and correct ance their use words and correct emonstrate skills and riers.	1,2, 3
No. I	i. Inte Sente ii. Ty iii. Co Voca i. O ii. H iii. W iv. Ic Liste i. Wha ii. Typ iii. Ut Read i. Tec	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Development of the word substitution for sommon and Homo fords often confused flioms and phrases of the listening?  The soft Listening of the soft Listening inderstanding Listening ing Skills thiniques of Effective	tive and Assertive and Assertive Sentences t  t  pphones  Reading	6 6		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify list	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read	accurately orm various and correct ance their use words	1,2, 3 1,2, 3
No. I	i. Inte Sente ii. Tyj iii. Co i. O ii. H iii. W iv. Io Lister i.Wha ii. Typ iii. Un Read i. Tec ii. Ga	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Developmenthe word substitution formonyms and Homodords often confused floms and phrases in in Skills at its listening? The properties of Listening in Skills the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of the properties of Effective thering ideas and information in the properties of the properties	tive and Assertive and Assertive Sentences  t  pphones	6 6 5		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify list	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read	accurately orm various and correct ance their use words accurate skills and riers.	1,2, 3 1,2, 3
No. I	i. Intel Sente ii. Ty iii. Co  Voca i. O ii. H iii. W iv. Io  Lister i.Wha ii.Typ iii. Ur  Read i. Tec ii. Ga iii. Th	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Developmentone word substitution formonyms and Homory ords often confused dioms and phrases ming Skills at its listening maderstanding Listening ing Skills thiniques of Effective thering ideas and informe SQ3R Technique	tive and Assertive and Assertive Sentences of the phones o	6 6 5		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify list  Students vand einformation	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read extract n using	accurately orm various and correct ance their use words accurate skills and riers.	1,2, 3 1,2, 3
II III	i. Intersection Sente ii. Typiii. Colii. Hiii. Wiv. Ice ii. Whatii. Typiii. Un Read ii. Tec ii. Ga iii. The Time	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Developmenthe word substitution formonyms and Homodords often confused floms and phrases in in Skills at its listening? The properties of Listening in Skills the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of Effective thering ideas and information in the properties of the properties of Effective thering ideas and information in the properties of the properties	tive and Assertive and Assertive Sentences and Assertive Sentences are phones.  The phones are are a sentences are a sentence are a sen	6 6 5		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify lis  Students vand einformation technique.  Students manage	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read extract n using will their tir	accurately orm various and correct ance their use words and correct emonstrate skills and riers.	1,2, 3 1,2, 3
II III	i. Inte Sente ii. Tyj iii. Co i. O ii. H iii. W iv. Io Lister i. Wha ii. Typ iii. Un Read i. Tec ii. Ga iii. Th	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors bulary Development of the word substitution for some and Home Words often confused flioms and phrases of Listening Skills of Listening in Skills of Effective thering ideas and informed SQ3R Technique  Management Skills	tive and Assertive and Assertive Sentences and Assertive Sentences are phones.  The phones are are a sentences	6 6 5		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify lis  Students vand einformation technique.  Students	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read extract n using will their tir	accurately orm various and correct ance their use words are skills and riers.  efficiently relevant the SQ3R	1,2, 3 1,2, 3 1,2, 3
II III	i. Intersection Sente ii. Typiii. Colin ii. Hiii. Wiiv. Ice ii. What ii. Typiii. Ur. Read ii. Tec ii. Ga iii. The Time ii. Intrii. Pur Mana	mmar (flipped classrenchange of Interrogances, Exclamatory argues of Tenses ommon Errors  bulary Developmente word substitution formonyms and Homodords often confused dioms and phrases in ming Skills at its listening derstanding Listening in the SQ3R Technique  -Management Skills oduction to Time Management Skills	tive and Assertive and Assertive and Assertive Sentences and Assertive Sentences are sentences.  The phones are sentences are sentences are sentences are sentences are sentences are sentences.	6 6 5 5		Students construct a sentence grammatics.  Students vocabulary accurately  Students effective identify lis  Students vand einformation technique.  Students manage	will nd transfo types an al errors. will enha and u in context will d istening tening bar will read extract n using will their tir	accurately orm various and correct ance their use words are skills and riers.  efficiently relevant the SQ3R	1,2, 3 1,2, 3 1,2, 3 1,2,

#### **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			Environn	nental	Scien	ce	1			ı
Course	code	23UBES101R	Total credits: 2	L	T	P	S	R	O/F	C
		2702	Total hours: 30	2	0	2	0	0	0	2
Pre-req		Nil	Co-requisite				N	il		
Program			Bachelor of S							
Semes		4.50	Fall/ II semester of							
Cour			lents for careers as lea				_			olex
Object			ues from a problem-o			_		_		
		_	orld population that is problems and which I							
			to work individually a			_				
			vention of new ones.	iliu coli	CCIIVE	Ty tow	arus sc	nutions	or curren	L
CO			be able to appreciate	the ethi	cal c	r088-011	ltural	and his	storical co	ntext
		of	oe able to appreciate	the ethi	car, c	1035-04	ituiai,	and m	storicar co	πολι
			ues and the links betw	veen hu	man a	and nati	ural sv	stems.		
CO			n about natural resour						ental impa	ets of
			on natural resource	, -	1				1	
CO	3	Gain knowledge a	about environment an	d ecosy	/stem.	Stude	nts wil	l be ab	le to unde	rstand
		the concept of bio	diversity and respect	them						
CO	4	Gain knowledge a	bout the conservation	n of bio	divers	sity and	its im	portan	ce.	
CO	5	Aware students about problems of environmental pollution, its impact on human and								
		ecosystem and control measures.								
Unit-		Conte	nt	Cont		L	earnir	g Out	come	KL
No.	7.5.1.4			Hou	ır					
I	l	disciplinary natu				Enviro			studies	
	l		Definition, scope						to tackle	
	and in	nportance, Need fo	or public			enviro multid			sues. Its	
	aware	ness.		4				•	approach complex	1,2
								_	awareness	
						•			vital for	
								ıstaina		
II	Natur	al Resources: Re	enewable and non-			Natura	source			
	renew	able resources,	Natural resources			renew		and		
	and as	ssociated problem	s. Forest resources:			renew	able, f	ace ex	ploitation	
	Use a	and over-exploita	tion, deforestation,			issues	,		including	
	case	studies. Timber	extraction, mining,			defore	station	ı, ove	eruse of	
	dams	and their effects	on forest and tribal			water		1	resources,	
			es: Use and over-			enviro			hallenges	
			and ground water,				ninera		food, and	
benef Use a of ex			s over water, dams-	6		land			gradation.	1,2
		-	Mineral resources:						a crucial	
		•	vironmental effects				1 cons	_	resources	
			mineral resources, ources: World food			and sustain	nahilis	_	promoting	
			sed by agriculture			sustall	iauiiit	y <b>.</b>		
	_	-	fects of modern							
		C C	esticide problems,							
	_	_	ty, case studies.							
			wing energy needs,							
	5	, 552 - 550 (	-55, 110005,							1

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

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

			SEMESTER	– II						
Course 7	ourse Title Extra-Curricular Activities									
Course	code	23UBEC121	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	nme		Bachelor of Sci	ence i	n Biot	technol	logy			
Semes			Fall/ I semester of fire							
Cours			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								
		performance to identify areas of improvement.								
CO3			etive essay or present							
		activities has contributed to their personal and professional growth, and design a plan for								
	ı		and skill development.	T ~	1					
Unit-		Cont	tent		ıtact	L	earnii	ng Out	come	KL
No.	D	1 4 1	, , , , ,	H	our	C/ 1		'11 1	- 41	-
I			's interest they can			Stude			nave the	
	•	•	sports, music, and co-				•		plore and	
		versity (Football,	ning the clubs of the Footshal; Cricket;				•		erests by variety of	
		• ` ` '	Footshal; Cricket; ll; Badminton; Table			-		-	and co-	
		<b>O</b> 7	ner outdoor and indoor			•	*	usic, ctivities		
						curric	uiar ac	Suvine	S	
			Vocals; Photography; ies); The students are	6	50					1,2
		•	<i>*</i> :							
			pate in regular club competitions as per							
		-	ies; Renowned skilled							
		essionals/ person								
	•	-	to promote the talents							
	_	nising workshops in students.	to promote the talents							
OI t		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						
<b>Course Title</b>	rse Title Co-Curricular Activities								
Course code	23UBEC111	Total credits: 1	L	T	P	S	R	O/F	C
		Total hours: 60	0	0	0	4	0	0	1
Pre-requisite	Nil	Co-requisite				N	il		
Programme		Bachelor of Sci							
Semester	2 5	Fall/ I semester of f							
Course		tain physical and ment							t best
Objectives	_	rs for state, national and							
		ce and improve student ama, etc through AdtU					_	yoga, musi	c,
CO1		n to work well with oth							
CO2		n to manage their time							
CO2		ance their creative abili					ally		
CO4		rove their overall health					any.		
CO5		ome more aware of their					ribute	positively.	
Unit-	Cont		_	tact			ng Out	•	KL
No.			Но	our			0		
rang com typic eduction and devel	e of experiences plement academic cally organized a cational institution play a crucian colopment. Some ex-	ysical Activities ities: bs and Competitions ervice and d Personal	6	0	6. 7.	Enlisuc lead com and thir Hold Surger and dev alor aca lear Perinter pee and Per Ful Pro for	velopment of the second of the	g skills camwork, o, cation, critical Growth: ng l, social, physical nent set to with mentors, ssionals.	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)	Mapped Program Outcome					
1	Students will learn to work well with others and communicate better.	2, 6, 8					
2	Students will learn to manage their time and stay organized.	2, 6, 8					
3	Students will enhance their creative abilities and think more critically.	2, 6, 8					
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 contribute positively.	2, 6, 8					

SEMESTER – III									
Course Title Immunology									
Course cod	e 23BSB211R	Total credits: 4	L	T	P	S	R	O/F	C
D	, N.O.	Total hours: 45T + 60	0P 3	0	2	0	0	0	4
Pre-requisit		Co-requisite	: D:4.	. 1 1 .		Nil			
Programm Semester		Bachelor of Science i							
		students immunology		_	_		المامات	ovrto1	·in 00
Course Objectives	interleukine, vacc 2. To explain the co	cines and autoimmunit omponents of immune siques like RIA and EL	ty. systems,	antige	en ant	ibody	react	tion,	
CO1	Describe the general intro involved in it.	oduction of immunolog	gy and th	ne vari	ous c	ells an	d org	an	
CO2	Discuss the mechanism o	f immune system.							
CO3	Demonstrate and analyse	various immune based	d experii	nents i	using	RIA,	ELIS	A	
CO 4	Apply the concepts and ty	-		ition p	roces	s.			
CO 5	Illustrate the types and fo		iseases.						
Unit-No.	Conten	t	Conta		Learr	ning C	utco	me	KL
T	Introduction to Immuno	lagys Immuna	Hour 8		7000	.h :11	11atma	to	
	I Introduction to Immunology: Immune system; Natural & acquired immunity; General properties of immune responses: Cells, tissues and organ of immune system			i	Describe, illustrate and explain the immune system and its components				
II	Immunity: Acquired, Innahumoral Immunity; T activation, maturation. antibody: structure, fund Antigenicity and immunantibody interactions	cell and B cell  Antigen and etion and diversity,	10	I a	ind mmu ind	ibe, i	illustr expl antig	ain gen	1,2
III	Cytokines and chem families, cytokine antagon disease, Immunogenicity. I			a	Descr and Cytok nterle				1,2
IV	Protective Immunity: a immunization; conjugate vaccine; adjuvants; rec DNA vaccine.	e or multivalent	10	a c	ind liffero accir		expl ype		1,2
V	V Autoimmunity & auto-immune diseases, factors contributing development of auto-immune diseases, mechanism of development, breakdown of self-tolerance, rejection of transplants, molecular mimicry, diagnosis & treatment of auto-immune diseases, eplacement therapy, suppression of autoimmune processes, transplantations		10	a	ınd ıutoin	ibe, i nmuni mmun es	expl ty a		1,2
Practical	Precipitation Reaction: i. Double Diffusion I ii. Single Diffusion R iii. Ouchterlony immu iv. Immunoelectrodiff	Reaction eaction modiffusion	60		Able ELISA	to A, RIA	oper	rate	1,2, 3,4

	lutination Reaction:	(Qualitative	and		
qua	titative)				
WII	OAL, ASO, VDRL, RPR	R, CRP			
Bloo	d grouping and Rh typi	ng, 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	Molecular Biology								
Course code	23BSBT212R Total credits: 4		L	T	P	S	R	O/F	F C
		Total hours: 45T + 60P	3	0	2	0	0	0	4
Pre-requisite	Nil	Co-requisite			•	Nil		•	
Programme	Bachelor of Science in Biotechnology								
Semester		Fall/ II semester of first	year of	the p	rogra	mme	;		
Course	1. To teach th	e basic concept of genom	e organis	sation	n and l	Nucle	ic aci	d, ope	eron
Objectives	concept, ho	oliday model.							
	2. To teach th	e central dogma of life in	detail.						
CO 1	Explain the organiz	ration of genome, its comp	ponents	and f	unctio	ns.			
CO 2		ss of replication, transcrip			, and p	rotei	n synt	hesis	
CO 3	Describe the DNA	repair mechanism and tra	nspositio	n.					
CO 4	Apply the knowled	ge of genomic and plasmi	id DNA	isolat	tion ar	nd the	ir pol	ymorj	ohism
CO 5	Illustrate genetic co	ode, Wobble hypothesis.							
Unit-No.	(	Content	Conta	ct 1	Learn	ing (	)utco	me	KL
			Hour					_	
I	eukaryote genome value paradox; ge semi conservati replication; DNA (Cot curve analy sequences (satelli etc); DNA meltin neucleosome phase	re-association kinetics ysis); repetitive DNA te DNA, LINE, SINE g and buoyant density; ing.	8		Understand the blueprint of life and its function				1,2
II	DNA Replication Replication initi termination in eukaryotes, Hom at the molecular double stranded by	8		Describe, illustrate and explain the process of DNA replication and recombination				1,2	
Ш	DNA damage a Nonsense, missen Intragenic and Frameshift mutati and biological mu Transposable g prokaryotes and of of transposition, mutation, Base Nucleotide excis correction, SOS re	nd Repair: Mutation- se and point mutations, Intergenic suppression, ons, Physical, chemical tagens, Transposition - enetic elements in eukaryotes, Mechanisms Role of transposons in e excision repair, tion repair, Mismatch epair.	8		Describe, illustrate and explain the process of DNA damage and repair mechanisms.				1,2
IV V	Post Transcription Processing of hnl Cap formation, polyadenylation, nuclear export of	alkaryotic Transcription. al Modifications: RNA, tRNA, rRNA, 5'- 3'-end processing and splicing, RNA editing, mRNA, mRNA stability achinery, Ribosomes,	8	-	Describe, illustrate and explain the process of transcription and editing of various RNAs Describe, illustrate			1,2	
•	Composition and	U		and ex				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 Title Genetic Engineering															
Course code		23BSB213R	<b>Total credits:3</b>	L	T	T P S R			<b>O</b> /	F	C				
			Total hours: 45T+30	P 3	0	2	0	0	0		4				
Pre-requis		Nil	Co-requisite			Nil									
Programi		Bachelor of Science in Biotechnology													
Semeste			Fall/ III semester of first year of the programme												
Course		1. To familiarize the molecular and genetic tools used to analyse genomes, modify													
Objective	es	genetic material and techniques for modifying organisms to produce desired products.													
		2. Plan for and manage formulation and execution of protocols and innovative													
		technologies and/or products.													
		3. To expose students to various techniques to enhance organisms so that they are								/ are					
			e to thrive in certain en		nts.										
CO1		•	pts of genetic engineer												
CO2			chniques and the types												
CO3		*	nstrate molecular detec												
CO4			ications of recombinar				•								
CO5	I	11.0	s of disease detection u												
Unit-No.		Con	tent	Conta		Learning Outcome			ie	K	(L				
Ī	Int	moduation to Co	motio Engineering	Hour 8		Underst	and th	2							
1			enetic Engineering: ad scope. Restriction	•	- 1	concept					_				
			characteristics and		- 1	enginee	_			1	,2				
	uses														
II		cloning and cloning vectors: plasmid					be and illustrate g techniques								
		tors, λ vectors.	Construction and c DNA library and		'	cloning	techni	ques		1	,2				
	1	NA library	c Divit holdry and												
III		lecular detec	_	8	- 1	Describ			and						
		thern, Northern				explain molecular detection and analysis									
			erase chain reaction Fragment Length		- 1	detection method		analys	51S						
		ymorphism(RFLP)			1	nemou	3			1	,2				
	Am	plified Polymorp	hic DNA (RAPD),												
		A finger printing	C												
		•	eoxy and chemical												
IV		uencing methods ctical application	n of Recombinant	10	1	Describ	e, illus	strate a	and						
1,			gineering of bacteria,			explain									
			d biopharmaceuticals		(	of recor	nbinar			1	,2				
		ulin and grow			1	echnol	ogy			•	,_				
		smid in plant bio duction	technology, Vaccine												
V			of disease: AIDS,	10	1	Describ	e, illus	strate a	and						
	Sicl	kle chain anaen	nia, cystic fibrosis,			explain	the me	ethods		1	,2				
Du		chenne muscular d	ystrophy			for dise			ı	1	,_				
Practical	In all	otion of DNA f	voniona a	60		using m									
rractical			rom various sources, noresis, SDS PAGE,	OU		Able to nethod			,						
			tion of DNA & RNA			of DNA		-		1,2	2,3,4				
	by U	JV Spectrophotom	etry			Proteins									

- 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	R- III							
	se Title		English La	nguage		celle					
Cours	se code	23UBPD212R	Total credits: 2	L	T	P	S	R	O/F	C	
D		NT*1	Total hours:60P	0	0	2	0	0	0	2	
	equisite	Nil	Co-requisite	\ \ain_a	. Dia4	l		Nil			
	ramme nester		Bachelor of S					mo			
	urse	1 To acquei	Fall/ III semester o								
	ectives	<ol> <li>To acquaint students with the various tools of effective presentation.</li> <li>To acquire the speaking skill instruct, influence, engage, educate, or appease the</li> </ol>									
Obje	ctives	listeners.									
		3. To increase proficiency, present ability and quality of resume and provide guidance for									
			otion and self-evaluation	-	_	-		•	Č		
		4. To prepare	e and train the students for	or the ca	mpus d	lrive	s & walk	cing into	erviews.		
C	O1		use prepositions, construc	-	e, comp	olex.	and con	npound	sentences, a	ınd	
	01	_	active and passive voice								
C	02		basics of writing, how to	avoid a	mbigui	ty, v	vrite para	agraphs	and letters,	and	
		prepare resumes an		,· ·	c ·	,•	1	. , .	1.1	•	
	03	_	uct SWOT analyses, prac								
	O 4	their impact.	h knowledge about non-	-verbal	commu	ınıca	mon, typ	es of t	oody langua	ge, and	
C	O 5	Train students in	planning and conducti	ng gro	up disc	cussi	ons, eff	ectivel	y disagreeii	ng, and	
	0.6	summarizing to atta							C 11		
C	O 6		or personal interviews, and adhere to dress cod					uestion	s, follow te	lephone	
Unit-			ontent	ic and g	Cont	_		rning (	Outcome	KL	
No.					Hou						
I	Gramn	nar (Flipped classro	oom)						correctly use	;	
		f Prepositions					preposi	tions,	create		
	1	le, complex, compound sentences ve and Passive Voice					various		sentence	1 / 4	
	iii. Acti						structures, and convert between active and				
							passive				
II	Writing							write clear	1 /		
		Basics of Writing; agraph Writing	avoid ambiguity and vag	ueness	6			paragraphs s, and cover			
		ter Writing					letters.	-			
	1	ume and Cover Lett	er								
III		anagement Skills					Student				
		T Analysis			5		SWOT regulate		yses, self- adhere to		
		Regulation					persona		hygiene		
		onal Hygiene					practice	es.			
IV			ion-Sciences of Body						understand	1 1	
	Langua	0			_		and differen	effecti t type	vely use s of body		
			munication & Body Lang	guage	5		languag		ir		
		s of Body Language ortance and Impact o					commu		1.		
V	_	Discussion	Thou, Language,				Student	s will	plan and	1 3, 4	
•	_	ing and Elements of	Group Discussion				particip		in group		
	1	ctively disagreeing,	1		5		discussi	ions,	disagree	;	
		marizing and Attain	ing the Objective.				constru		and cussions.	l	
VI	Intervi	ew Skills & Dress c	ode Ethics						demonstrate	2, 3	
•		nal Interview – Conc					effectiv		interview		
			tions and answering Stra	tegies	5		techniq		answei		
		phone Interview Eti	_	_					ions, follow		
		duction to Dress Co	=				dress ap		juettes, and ately.	1	
<u> </u>	1				1		al	Probin			

	CO PO Mapping								
SN	Course Outcome (CO)	Mapped Program Outcome							
1	Integrate presentation, communication, leadership, and	6,7							
1	interview skills.	0,7							
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								
Course Title	Te	chno-professional Sk	ills – I	I (Bio	fertiliz	zer Pro	ducti	ion)	
Course code	23BSB214R	Total credits: 1	L	T	P	S	R	O/F	С
		Total hours:30P	0	0	2	0	0	0	1
Pre-requisite	Nil	Co-requisite				N	il		
Programme		Bachelor of Sc	ience	in Bi	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 t	o Far	niliarize w	ith the
Objectives	basic principle and	l techniques of Biofarn	ning						
CO1	Explain the Importance of biofertilizers in plant development.								
CO2	Describe mass cultivation and inoculation.								
CO3	Explain the importance of Azolla as a biofertilizers.								
CO 4	Describe the importance of phosphate in biofertilizers.								
CO5	Apply the knowled	dge on the use of Fungi	and	Мусо	rrhiza.				
Unit-No.	C	ontent	Con	tact	L	earninş	g Out	come	KL
			Н	our					
I	Isolation, identi	fication and analysis	30		Stude	ents wi	ll be	able to	1,2,3,4
	of the potentia	lities of N2 fixing			understand the process of			rocess of	
	bacteria, Isolatio	n, identification and			biofe	rtilizer	pr	roduction	
	analysis of th	e potentialities of			using	g micro	oranis	sms	
	phosphate sta	-							
	Isolation , iden	tification and assess	s						
	the potentialiti	es 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	ır Acti	ivities					
Course	code	23UBEC211	Total credits: 1	L	T	P	S	R	O/F	C	
			Total hours: 60P	0	0	0	4	0	0	1	
Pre-requ	isite	Nil	Co-requisite				Ni	il			
Progran			Bachelor of Scientific	ence i	n Biot	technol	logy				
Semest		Fall/ III semester of first year of the programme									
Cours			in physical and menta						and selec	t best	
Objecti	ves		for state, national and				•				
			e and improve student's				•		ga, music	,	
			na, etc through AdtU cl								
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									
~~~			ntify areas of improven								
CO3			tive essay or present								
			ibuted to their personal	and 1	protess	sional g	growth	i, and o	design a pl	an for	
TT *4			and skill development.		4 4	Learning Outcome KL					
Unit- No.		Cont	tent		ntact our	L	earnii	ig Out	come	KL	
I I	Race	ed on the learner	's interest they can	110	Jui	Stude	nte s	vill ł	nave the	+	
1			ports, music, and co-						plore and		
			ning the clubs of the						erests by		
			Footshal; Cricket;						variety of		
		•	ll; Badminton; Table			•		sic,	•		
			ner outdoor and indoor					tivitie:			
			Vocals; Photography;			Cullic	uiai av	oti v itic.	3		
			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.	o promote the talents								
	01 111	o bradelito.									

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 '	Γitle		Co-Curri	cular	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	isite	Nil	Co-requisite				Ni	il			
Progran			Bachelor of Sci								
Semes			Fall/ III semester of f								
Cours	-		physical and mental						and selec	t best	
Objecti	ves	_	or state, national and in				•				
		l .	2. To enhance and improve student's talents in the field of sports, yoga, music,								
CO1		· · · · · · · · · · · · · · · · · · ·	na, etc through AdtU to work well with othe						S.		
CO1			to manage their time a				e belle	1.			
CO2							critical	11v			
CO ₄		Students will enhance their creative abilities and think more critically. Students will improve their overall health and reduce stress.									
COS				role in society and contribute positively.							
Unit-		Cont		_	ntact			ig Out		KL	
No.					our	_	• • • • • • • • • • • • • • • • • • • •	-5			
I	Co-c	curricular activit	ies cover a wide			1.	Skil	1 Dev	elopment:		
	rang	ge of experiences	s and pursuits that			Enhar	such as				
		aplement academic learning. They are				teamwork, leadership,					
		cally organized and managed within				communication, and critical					
		cational institutions or communities play a crucial role in holistic elopment. Some examples are				thinki	•				
						2. Holistic Gro					
						Suppo	_	emotional,			
		13. Sports and Phy	-			social	_	and	physical		
		14. Cultural Activ		,	CO	develo	•		alongside	1.2	
			bs and Competitions	(50	acade:		arning.	Networks:	1,2	
		16. Community Se	-			•		_	inities to		
		Volunteering	01 + 100 unu				_	• •	, mentors,		
	-	17. Leadership and	d Personal			and pi		•	,,		
	-	Development	u i Cisonai			Person			ılfillment:		
		18. Creative and F	Johny-hased			Providing avenues for					
	-	Activities	1000y-0ascu			creati	_	self-e	xpression,		
		Activities				and	explo	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 – III										
Course T	itle			ntomolo	ogy					,	
Course c	ode	23FSZO301R	Total credits: 2	L	Τ		S	R	O/F	C	
-		2741	Total hours: 30T	2	0	0	0	0	0	2	
Pre-requ		Nil	Co-requisite	<u>. </u>	ъ.		N	<u>il </u>			
Program		10	Bachelor of So								
Semest Cours			all/ III semester of s						tica of it	• a o o t a	
Objectiv		1. Understand the classification, morphology, and key characteristics of insects, focusing on Class Insecta.									
Objectiv	ves		2. Explore the morphology and adaptations of insect mouthparts, antenna, and legs.								
			e life cycles and cor								
		1	on human health.			200 01 111		.jp .	Per		
			insect communication	n metho	ds	and beha	viors,	includ	ing their i	ole in	
		pest management and forensic science applications.									
CO1			view of Class Insect				gical n	nodific	ations.		
CO2		Able to explain the	life cycle and control	measur	es o	of pest of	medic	al impo	ortance.		
CO3		•	llustrate different c			•				havior	
		adopted by insects.				<i>J</i> - 1111	1				
CO4		Able to explain, il	lustrate and implem	ent diff	erei	nt manag	gement	t strate	gy adopt	ed for	
		controlling insect pe	ests.								
CO5			different insects of e							_	
Unit-		Conte	nt	Contac		Learning Outcome				KL	
No.	T 4	1 4 4 E 4	1 0 :	Hour	'	Describe and explainthe class					
I		roduction to Entor					e and				
		Class Insecta, its racters.	classification and			of In					
	Inse		Overview and	5		morphor	ogicai	pecun	arrics.	1,2	
	1	difications of mouth									
	legs		parts, anti-min and								
II		t of medical impo	rtance: Life cycle			Describe	e, i	llustrat	e and		
	and	control measures of	f Musca domestica,			explain the life cycle and					
		'es aegypti, Culex			control measures of pest of						
		pheles, Phlebotom		7		medical importance.					
			es, Cordylobiaanthropophaga,								
		uliumdamnosum, Pi									
		ularius, Triatoma ii	yestans, Peatculus								
III	Inse	anus. ect communica	tion: Chemical		\dashv	Describe	<u>.</u> ;	llustrat	e and		
111		nmunication, Aud					-		different		
	1	munication, Visua				commun			chniques		
		ninescent insects	,						lopted by		
	Inse		Chemotropism,	6		insects.			. ,	1,2	
	Thi	gmotropism,	Hydrotropism,								
	1	heotropism, Anemotropism,									
		•									
	_	tropism.									
IV		e of insects in p				Describe	-	llustrat			
		ef about chemica	l and biological	5		explain		ie	different	1,2	
		trol of insect's pest,	io soionos						adopted		
V		e of insects in forens				for contr Describe		insect llustrat		+	
•	V Introduction to Applied Entomology: Life cycle, by product and commercial						_				
		hod of farming of ho							1,2		
		lac insect.	mey occ, siikwoiiii			51 660110	71111C 11.	прогии			
	and	ine mocet.									

- 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							

			SEMESTEI	R – III							
Course T	itle		SEMESTE	Forestr	V						
Course c		23FSBO301R	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				N	il			
Program		Bachelor of Science in Microbiology									
Semest	er	Fall/ III semester of second year of the programme									
Cours	-		1								
Objectiv	ves	2. Basic knowledge of forest dendrology, forest types									
		3. The course further deals with physiology of forest, forest management and forest									
CO1		pathology. Articulate the history and basic concept of Forestry.									
			•		•						
CO2		_ ^	lrology and knowled	~							
CO3			Understanding of forest types and forest management mportance of physiology in forestry								
CO4			orest pathology, caus	ass of for	oat d						
CO5			1 00,								
Unit-		Conte	nt	Contac	et	Le	arning	g Outc	ome		KL
No.	T4-	uaduatian Fanast	History of	Hour): l-	1	1	II:		
I		roduction Forest estry, Classification				ypes an			inHistory	,	
		cepts on forest		'	ypes an	u pon	0105 01	101051			
		ortant acts and p	5								
		lian Forest.									1,2
	For	est management: D	Definition and scope								
	of 1	forest management, principle of forest									
		nagement and their a									
II		ndrology: Introducti			Describ	_	illustra				
		pe of dendrology.						scope and			
		phology in identifest flora	ication of woody				rphology of woody forest l Ecotourism				
		o tourism: Definition	n and elements of	7	a	na Eco	tourisi	11			1,2
		tourism, Principles									
		tourism. Potential									
	Indi										
III	Pla	nt Physiology: In	troduction to tree			Describ		illustra	te and	1	
		siology, Photosynthe				xplainI			of tree		
		forest trees, transpi		6		hysiolo		n rel	ation to)	1,2
		opies, environmenta	l effects on growth		1	orestry.	•				
IV		development.	Divorgity: Forget		Г	Describ	2 :	illustra	to one	1	
1 V		es of India, Forest					,		te and of fores		
	and		•						d abiotic		
		raction, Nutrient	cycling, forest	5		ompon		and	fores	- 1	1,2
		nagement. Conserva	· ·			management and ecotourism.					
	of o	diversity, diversity h				ū					
		onservation.									
V		est Pathology: Im			Describ	,	illustra				
		nology. Principles o			xplain			of for			
		ses of forest diseases									1,2
		nological, general s disease, control			C	iseases	and p	ıant qu	arantine.		
		nt quarantine.	or rolest diseases,								
	Piai	n quaramme.			I						

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								

			SEMESTE									
Course	e Title		Basic Life S	Saving S	kill	s (BLSS))					
Course	e code	23UULS202R	Total credits: 1	L	T	P	S	R	O/F	C		
			Total hours: 30P	0	0	1	0	0	0	1		
Pre-re		Nil	Co-requisite				Ni	il				
Progra			Bachelor of So									
Seme				f second year of the programme								
Cou		The aim of the cour	se is to provide the	learners	with	basic kı	nowle	dge an	d practical	l skills		
Objec			ency fire situation, a	ind to pr	OV10	le approp	oriate	basic r	nanageme	nt and		
		treatment for injurie		• ,		. / 1:			1 1			
CO			able to recognize res	spiratory	arre	est/ cardi	ac arre	est, and	l provide (oxygen		
CC		to the patients to sus	e able to perform the	a impa	tono	of com	lv CD	D on	A dult ahi	ld and		
		infants victims	e able to perform th	ie iiipoi	tanc	e or ear	ly Cr	K OII A	Adult, Clii	iu anu		
CC		The students will be able to prevent injury from getting worse, aiding recovery, relieving										
	,5		pain and protecting the victims from deterioration									
CC)4		mportance of physiology in environmental emergency									
CC			able to learn about t				auiren	nents 1	methods o	f		
		operation and getting		1110 00	1⊶.b		1011011	, 1		-		
Unit-				Contac	et	Les	arning	Qutc	ome	KL		
No.		Conten	-	Hour		200		,				
I	Basic	Life Support (BIS)			;	Students	will g	ain fou	ındational			
	•	Introduction of BI							ical skills			
	•	Chain of survival			j	in Basic	rt (BLS),					
	•	ABCs Assessment	t	5	(enabling	them	i to e	effectively	/ 1,2		
	•	CPR and Ventilati	on Technique			respond	to	e	mergency			
	•	AED	1			situations.						
	•	Choking for adult	and children									
II	First				- 1	Students	will a	acquire	essential			
	•	Golden rules of Fi	rst aid	5		knowledge and skills in First						
	•	First aid Kits				Aid						
III	Tram	ma emergencies			+	Students	will s	acquire	essential			
***	•	Introduction				Students will acquire essential knowledge and skills in						
			al approach in pre-			Trauma e	_					
		hospital care	a approach in pre				8					
	•	Scene safety										
	•	Primary assessmen	nt									
	•	Bleeding control		5						1,2		
	•	•	victims and safe									
		transfer										
	•		abilization and C-									
		collar application										
	•	Splinting of broke	n Limbs									
IV	Triag	e system			;	Students	will a	acquire	essential			
	•	Introduction						_	in Triage	1		
	•	Flow chart approa	ch of Triage	5		system			-	1,2		
	•		le and Multiple									
		Casualties in Pre-l										
V	Medi	cal emergencies			- 3	Students	will a	acquire	essential			
		luction			1	knowled	ge a	ınd s	skills in			
	Victin	n centred approach a	nd Management of			Medical	emerg	encies				
	•	Seizures		3	1					1 2		
	•	heart attack		3						1,2		
	•	asthma										
	•	diabetic emergenc										
	•	emergency childb	irth									

	Respiratory distress and failure		
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	Students will acquire essential knowledge and skills in Environmental Emergency
VII	 Safety of people in the event of fire Recognition of possible fire sources and emergency procedures, Construction techniques for eliminating fire. Types of detecting devices and extinguishing agents and systems Devising procedures in the event of fire and react to fire danger. Safety goals and objectives, Identifying hazards and risks 	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 Fi									
Course c	ode	23UUFL202R	Total credits: 1	L	-	T	P	S	R	O/F	<u>C</u>	
Pre-requ	icito	Nil	Total hours: 30P Co-requisite	0		0	1	0 N	0	0	1	
Program		INII	Bachelor of Scientific	nce	in	Riote	hno		Ш			
Semest		F	all/ III semester of se						mme			
Cours			1. The course would offer an inclusive approach to understand the relevant concepts									
Objectiv	ves	of money, b	orrowing, lending, tax	es ai	nd t	their a	plica	ation to	o finan	cial planr	ning.	
			personal financial plant	ning	pro	ocess,	the li	fe cycl	e of fi	nancial pl	ans,	
			s ofgoal achievement. budget, record-keepin	or cv	ctai	m ond	tov	nlonni	na atro	tagy baga	d on	
		current fina		ig sy	Sici	iii, aiic	iax	Piaiiiii	ng su a	icgy base	u OII	
CO1			agement strategy and	a pla	n to	o facil	tate	the hor	ne or a	utomobil	e	
		buying process		-								
CO2			d investment portfoli	o th	at	addres	sses	severa	l diffe	erent inve	stment	
CO3		objectives.	L	d	nt	.1 :	la ===	ohor:	2 tm2 1 -	ما المعاد	nd	
			en open- and closed-en l estate investments.	u ml	นเนล	ai iunc	is, ex	chang	z-trade	a runas, a	ıııu	
CO4			an that covers your inc	come	e ne	eds in	retir	ement	and he	elps protec	et you	
		and your estate.	<u>,</u>							1 1		
Unit-		Cor	ntent		Contact Learning Ou			utcome	KL			
No.	E	damentals of Fina	saial Dlanning		J	Hour	C	tudanti	. xx;i11 .c	cquire		
1		damentals of Final nctions of money;	iciai Pianning –							-		
		uses, how it can be					essential knowledge of Fundamentals of					
	con	trolled; iii.process of	ficial planning,					inancia				
			-simple and compound			5	1	manon	41 1 IUII	ming	1,2	
			alue and Future value, ling; vii.Doubling per									
		Rule of 72.	inig, vii.Douoinig per	Iou								
	and	Rule of 72.										
II	Inco	ome Tax Planning-	i.Meaning of Income,				S	tudent	s will a	cquire		
		irect & Indirect Tax			essential knowledge					ledge		
		ious heads of Income for tax Calculation, Non-taxable Income, Γax evasion and tax avoidance, v.GST, Tax				5	aı	nd skil	ls in In	come	1,2	
							T	ax Pla	nning			
		nning Strategies										
III		repreneurial plann	ing –				S	tudent	s will a	cquire		
	i. M	leaning of Entrepren	eurship, prerequisites t	for				ssentia		-		
	1	oming an entreprene					aı	nd skil	ls in			
			port Systems in India, tems for entrepreneurs			_	E	ntrepre	eneuria	ıl	1.2	
	1	11	items for entrepreneurs			5	p]	lanning	g.		1,2	
	1	enture Capital, Busi	•	,								
	vi. A	Assistant of Government	nent,									
		Commercial Bank L										
IV			in securities market -	-						cquire		
		vestment avenues of kets Primary Mark	-					ssentia		_		
		arkets,. Primary Market and Secondary arket,							ls in se	ecurities		
		Stock market- meaning, features, functions of					m	arket				
		SE,BSE DEMAT trading account,				5					1,2	
		Security repository, s										
		erational aspects of seement of	ecurities markets:									
	_		y-in and pay-out, tradi	ng								
		settlement cycle,	1 7	5								

	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 1	Biotechno	logy						
Cours	e code	23BSBT221R	Total credits:4	L	T	P	S	R	O/F	C	
			Total hours: 45T+30	P 3	0	2	0	0	0	4	
Pre-re		Nil	Co-requisite				N	il			
Progr			Bachelor of Sc			`					
Sem			Fall/ IV semester of			_					
Cou		1. The objective of this course is to combine the biotechnological applications									
Obje	ctives	studied in other courses and relate to food.									
			2. This will give students a comprehensive understanding of transgenic food, biotechnological food additives, biotechnological food diagnosis and								
		regulation	-	ves, bioi	ecimon	ogica	11 10	ooa (inagnos	sis and	
			oundational principles	of biotech	nology	and	its a	nnlica	tion in	the food	
C	D1	industry.	andational principles	or broteen	nology	ana	ns a	ррпса	tion in	the root	
			ce behind GMOs, their	developn	nent. th	neir r	ole in	ı food	produc	ction and	
CC)2	ethical issues.			,				F		
CO)3	Learn the principl	es and applications of	fermentat	ion in f	cood	prod	uction			
) 1		echnological approach							ing shelf	
CO	<i>)</i> 4	life.									
CO) 5	11	apply the knowledge on industry trends and innovations, including the development of								
			nutraceuticals, and bio								
Unit-		Conte	nt	Contact		earn	ing (Outco	me	KL	
No.	T . 1	1. 1 D. 1	1 . 4 . 1	Hour	Г 1	• 41		1	C		
I			nnology in the Food biotechnology and its	8	biote			levano in	the		
		•	roduction, historical		food			111	the	1,2	
	develo	•	ey milestones in		1000	muu	su y			1,2	
		nology in food	in the state of th								
II			Organisms (GMOs)	10	Unde	erstar	nd th	ne role	e of		
			ience behind GMOs:		GMC)s	in		food		
	genetic	engineering	techniques and		produ	uctio	n a	and	crop		
			SMOs in improving		_			and		1,2	
			sustainability, Ethical		ethic	al co	nside	eration	ıs.		
			oversies surrounding								
777	GMOs		7 D	0	D		C.		4		
III			Food Production : n and its significance	8	Desc			rmenta for	the		
	_		s of fermented foods		*			foods			
			cultures, Industrial		bever			10005	una	1,2	
		•	ogical advancements			8					
		nentation.									
IV	Biotec	hnological App	roaches to Food	10	Expla	ain	the	role	of		
	Safety	and Shelf	Life Extension:		biotechnology for						
		-	ds for food safety			_		od sa	afety	1,2	
		•	r extending shelf life		and p	orese	rvatio	on		1,2	
		-	studies and examples								
X 7		essful applications		40	Г		41	. 1	-		
V	Indust	•		10	Expla		the	role	of		
	function		merging trends in nd nutraceuticals,					for functi	the	1,2	
			nd nutraceuticals, les to enhance food		foods		ıı OI	1uncti	onai		
	DIOIOL	uncanon techniqu	ies to eimance 1000	1	10008	5.					

	nutritional value, Regulatory aspects and consumer acceptance of functional foods		
Pract ical	 Quality analysis of milk by MBRT Isolation of food borne bacteria and fungi from food products. Microbiological examination of canned foods. Isolation of spoilage bacteria from fruits and vegetables. Adulterant test: formalin and starch test Effect of temperature on the spoilage of food products. Production of fermented food: Yoghurt, Kim chi 	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/I	7	С
			Total hours: 45T	3	0	0	0	0	0		3
Pre-requ	uisite	Nil	Co-requisite			Nil					
Prograi	nme	Bachelor of Science in Biotechnology									
Semes	ter	Fall/ IV semester of first year of the programme									
Cour	se	1. To introduce animal and plant's embryonic development that is how an egg									
Object	ives		nto an adult.		•		-				
		2. To prepare for advanced courses such as Animal and Plant Biotechnology									
CO	<u> </u>	Learn the concept of gametogenesis, fertilization in plants and animals.									
CO2		-	ess of pollination and fe			•					
CO3			trate post-fertilization p					mals			
CO			ess of gamete formation		_						
CO			zation and embryonic st					111161			
Unit-	<u> </u>		-	Con				O	4		KL
No.		Content			ur	L	eariii	ng Ou	tcome		KL
	Como	togenesis-I (Ma	lo). History and	по	our	I In don	aton d	dagamil			1,2
I	Scope		le): History and			Understand, describe, illustrate					1,2
	embry	ology; Typical	Angiosperm Flower,			and explain gametogenesis					
		are of stamen,	Microsporogensis,	7	7						
	Dehisc		Gametogenesis- carpel, Types of								
		e Megasporogenesis; Structure of typical yo sac, (Polygonum, Allium and Adoxa									
	type)										
II			on: Pollination, Pollen	1.0				descri	be,		1,2
		ntry (Types), Syngan	10	0	illustrate						
	Double	le fertilization, Development of Endosperm				and explain pollination and fertilization					
III	Post-fe	ertilization: Types o	of endosperm,			ı		descri	be,		1,2
		sors and synergids,		1	0	illustrat					
	1 -	nbryony, Fruit- deve	lopment and			and ex	kplain j	post te	rtilizatio	n	
IV	matura Gamei		als-I, Ultra structure of			Under	stand	descri	he		1,2
1 4			matogenesis-Formation			illustrat					-,-
	of	_	_	_		gameto		s in			
			nesis, Ultra structure of	8	8	anima	ls				
			in amimals-II, Ultra								
		cture of Ovary in mammals, Oogenesis in nmals, Typical egg structure, Yolk-its									
	function	on and significances									
V	Fertili	zation in Mammals	: Sperm egg					descri			1,2
	encour Acroso	nter, Capacitation and	d Sperm transport,			illustrat fertiliza			1		
	reactio		ation and Amphimixis.	1	10		iuon ii nals	1			
			and Types of Clevage.								
	Blastu	lation and Gastrulati	on Salient features and								
	Signifi	cance									

- 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:

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							

			SEMESTER – I	V						
Cours	e Title		Bioinf	ormat	tics					
Cours	e code	23BSBT223R	Total credits:3	L]	ГР	S	R	O/F	C
			Total hours: 30T+30P	2	2 () 2	0	0	0	3
Pre-re	quisite	Nil	Co-requisite				Ni	l		
Progr	amme		Bachelor of Scien							
Sem	ester		Fall/ IV semester of first year of the programme							
Cou		1. To give basic computer knowledge and their practical application.								
Objec	ctives	2. Knowledge on computational database management system and its application in Biology								
		3. A basic idea on the structural biology using computer								
CO	D1		Learn basics of computer and its applications in Biology, including data analysis.							
CC			on various molecular sec							
CC			using bioinformatics tools	_					alysis.	
CC		*	retrieval and alignment o		•				_ •	
CC			ing biological database an		•					
Unit-		Cont		Con			ning (Outcor	me	KL
No.				Ho	ur	zem mig o utrome				
I			History of computers,			Unders		,		
			on of computers, Hardware			fundamentals of Computer Science				
			lock Diagram of Digital Capabilities of computers,	7	7	Compu	ici scie	THE		
	I/O device	ces, Storage devices,	R A M							
		Iemory unit- primary				T. 1	. 1.1			
II			troduction, Importance, VAN, Electronic Mailing,		Understand the fundamentals of				1,2	
		, Search Engine, We	5	5	Computer Networking			g		
		, Multimedia - Intr		and utility						
III	Applicat Database	ions, Components ar management				Describ	o DRM	IS and	their	1,2
111	Database	- management	system (DBMS)	5	5	types	D D IV	15 and	uicii	1,2
			agement system(DBMS)							
IV		ifferent types.	s and data generation-			Data re	trioval	and		1,2,
1 V			gnment (FASTA, BLAST,			alignm	0.1			3
	BLAT),	visualization softw	vare (RASMOL, MMDB	8	3	sequen		variou	S	
		MolMol etc). Flat				formats	3			
	calculation	<i>C,</i>	, physiochemical property							
V			eotide sequence databases			Describ	e	the		1,2,
		DDBJ, and EME						existin	- 1	3
	Speciali		PROT, PIR, G e n P e p t) tabases: (SGD, TIGR	5	5	biologi their	cal utilizat	databa	ise a	
			ATH, SCOP, and PDB,				ut1112al	1011		
	NDB, M	MDB), pathway data	abase(KEGG)							
Practi			y (nucleotide/protein)			Practic equenc				1,2,
cal		e with database seque mputing protein para	meters of a given protein	30	0	alignm			g	3,4
	sequence	and nalysis				protein	charact	teristics	5,	
	3. Co	mputingthe3Dstructu	ureofaproteinusing			and mo		proteir	1	
<u> </u>	1			l		su actu				

- 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 cl	nemi	stry							
Cour	rse 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	'			N	lil	1				
Prog	ramme		Bachelor of Sc	ience ii	n Bio	otechno	ology						
Sen	nester		Fall/ IV semester of										
Co	ourse	1. Introduce the students about concept of buffer, pH, acid and base, chemical											
Obj	ectives		nd the energy relations m understand how the		in fo	alde an	d wh	at nhe	nomenon	lea	d to		
		protein fo		c prote	111 10	nus an	iu wii	at phe		i ica	u to		
(CO1		s of pH, buffers and rel	ated th	eorie	es.							
C	CO2	Explain quantum mechanics and the laws associated with it.											
C	CO3	Illustrate the differ	rent bonding and force	s for in	terac	tion of	a mol	ecule.					
C	CO 4	Know the laws of	thermodynamics.										
C	CO 5	Explain the mecha	anism of protein folding	g									
		1 ^ -											
Unit		Conte	nt	Conta	ct	L	earni	ng Ou	tcome		K		
Unit -No.		Conte	nt	Conta Hou		L	earni	ng Ou	tcome		K L		
		uffer: Introduction	n; Bronsted & Lowry	Hour	r D	escribe	, illus	trate ar	nd explain		L		
-No.	theory; I	uffer: Introduction Lewis theory; Buf	n; Bronsted & Lowry fering action; Buffer		r D	escribe	, illus	trate ar					
-No.	theory; I Capacity Propertie	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water	n; Bronsted & Lowry fering action; Buffer Biological Buffers;	Hour	r D pI	escribe I, buff	, illus ers and	trate and relate	nd explain ed theorie	es	L		
-No.	theory; I Capacity Propertie Quantur	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape	Hour 10	r De pI	escribe I, buffe	, illus ers and	trate and relate	nd explained theories	n es	1,2		
-No.	theory; I Capacity Propertie Quantur of atomic	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's	Hour	r Dop Photos	escribe I, buffe	, illusters and	trate and relate	nd explain ed theorie	n es	L		
-No. I	theory; I Capacity Propertie Quantur of atomic law; Pho of atom.	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure	Hour 10	Do pH	escribe I, buffe escribe antum sociate	, illus ers and , illus mech d with	trate and relate trate an anics an it.	nd explained theories and explained the la	n es	1,2		
-No.	theory; I Capacity Propertie Quantur of atomic law; Pho of atom. Chemica	uffer: Introduction Lewis theory; Buf; ; H-H equation; s of water n mechanics: Ato c orbital); Black be toelectric effect; H	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen	10	Do pH	escribe I, buffor escribe antum sociate escribe	, illus ers and , illus mech d with	trate and relate arate an anics an it.	nd explained theories and explain and the la	n es	1,2		
-No. I	theory; I Capacity Propertie Quantur of atomic law; Pho of atom. Chemica	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen	Hour 10	Do pH	escribe escribe escribe escribe escribe escribe	, illus , illus , illus mech d with and e	trate and related arate an anics and it.	nd explained theories and explain and the lathe	n es	1,2		
-No. I	theory; I Capacity Propertie Quantur of atomic law; Pho of atom. Chemica bond; Pe	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H ll bonding: Ionic, ptidyl bond; Vande	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen er Waal forces w (concept of internal	10	Do pI Do qu as Do di fo	escribe escribe antum sociate escribe fferent r intera	, illusing the same of the sam	trate and related arate an anics an it. xplaining and of a material arate and arate	nd explained theories and explain and the last the last Forces olecule and explain	n ws	1,2		
-No. I II	theory; I Capacity Propertie Quantur of atomic law; Phoof atom. Chemica bond; Per Thermogenergy);	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H ll bonding: Ionic, ptidyl bond; Vande dynamics: First lay Second law (free	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's fybridization structure Covalent, Hydrogen er Waal forces w (concept of internal ee energy, enthalpy,	10 10	Do plass	escribe escribe antum sociate escribe fferent r intera	, illusing the same of the sam	trate and related arate an anics an it. xplaining and of a material arate and arate	nd explained theories and explain and the last the last Forces olecule	n ws	1,2 1,2		
-No. I II	theory; I Capacity Propertie Quantur of atomic law; Phoof atom. Chemica bond; Per Thermoenergy); entropy);	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H ll bonding: Ionic, ptidyl bond; Vande dynamics: First lay Second law (fre free energy in b	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen er Waal forces w (concept of internal ee energy, enthalpy, iological system, 3rd	10	Do plass	escribe escribe antum sociate escribe fferent r intera	, illusing the same of the sam	trate and related arate an anics an it. xplaining and of a material arate and arate	nd explained theories and explain and the last the last Forces olecule and explain	n ws	1,2		
-No. I II	theory; I Capacity Propertie Quantur of atomic law; Pho of atom. Chemica bond; Per Thermoenergy); entropy); law; Sigr Concept	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H l bonding: Ionic, ptidyl bond; Vande dynamics: First lav Second law (fro free energy in b inficance and limitals s of protein foldin	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen er Waal forces w (concept of internal ee energy, enthalpy, iological system, 3rd attion of the laws.	10 10	Do plant of the pl	escribe I, buffi escribe escribe escribe fferent r intera escribe e laws escribe	, illusters and extended with and extended bonding illustroof the	trate and related arate an anics an it. xplain ng and of a metrate an arate a	nd explained theories and the last the last last last last last last last last	n ws	1,2 1,2		
-No. I II III IV	theory; I Capacity Propertie Quantur of atomic law; Pho of atom. Chemica bond; Per Thermoenergy); entropy); law; Sigr Concept hydrophi	uffer: Introduction Lewis theory; Buf ; H-H equation; s of water n mechanics: Ato c orbital); Black bo toelectric effect; H l bonding: Ionic, ptidyl bond; Vande dynamics: First lav Second law (fre free energy in b nificance and limita	n; Bronsted & Lowry fering action; Buffer Biological Buffers; omic structure (Shape ody radiation; Plank's lybridization structure Covalent, Hydrogen er Waal forces w (concept of internal ee energy, enthalpy, iological system, 3rd attion of the laws. lg:(Amino acids,	10 10	Do plant of the pl	escribe I, buffi escribe escribe escribe fferent r intera escribe e laws escribe	, illusters and extended with and extended bonding illustroof the	trate and related arate an anics an it. xplain ng and of a metrate an arate a	nd explained theories and the last the last last last last last last last last	n ws	1,2 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									

	SEMESTER – IV												
Course '	Title		Basics of 1	Foo	d Scie	nce							
Course	code	23BSFD401R	Total credits:3	L	T	P	S	R		O/F	C		
			Total hours: 45T	3	0	0	0	0		0	3		
Pre-requ	ıisite	Nil	Co-requisite					Nil					
Progran	nme		Bachelor of Scien	Bachelor of Science in Biotechnology									
Semes		IV semester of first year of the programme											
Cour			foundational understandi	_						food.			
Objecti	ives	2. Learn the fundamental principles of food processing techniques.											
3. Explore the chemical reactions										and stor	age.		
CO		_	ional understanding of the			_			d.				
CO2			ental principles of food p										
CO3			cal reactions that occur d	urin	ig food	l pro	cessir	ig and	stor	age.			
CO ₄	1		s of food microbiology.										
Gain insights into sensory evaluation techn					es used	to a	ssess	the ta	ste, a	iroma, te	exture,		
TT	1	and appearance of			Contac	.	_		0 /		TZT		
Unit-		Coi	Content					rning	Out	come	KL		
No. I	T4	dustion to Food	Science: Overview of		Hour 6	Т.		basic		f food			
1					O		earn ionac	basic	s o	1 100a			
			s importance, basic arbohydrates, proteins,			SC	ience		1,2				
	_	vitamins, minerals	-										
II			niques: principles and		6	I I	nders	tand	haci	c food			
11			eservation (e.g., heat		U			ing te			1,2		
		_	ezing), techniques for			P	00000	mg ve	• • • • • • • • • • • • • • • • • • • •	ques	1,2		
	Γ	packaging and stora											
III			Food Processing and		8	Ех	plain	1	c	hemical			
			ges during cooking,				anges		ıring	food	1,2		
	baking	g, fermentation, an	d aging, factors			pr	ocess	ing ar	ıd sto	orage			
	influe	ncing chemical rea	ctions: pH, temperature,										
	enzyn	nes											
IV	Food	Microbiology: Int	troduction to food borne		8	Uı	nders	tand	m	icrobial			
	•		e organisms, microbial	1		ch	ange	5		during	1,2		
	growth kinetics and factors affecting micro					fe	rment	ation					
	_	h in foods											
\mathbf{V}		•	Food: principles of		8	Explain the principle of							
		ry evaluation: taste					nsory			ion of			
		rance, methods and	d techniques for			fo	od	for		quality			
	sensor	ry evaluation				as	sessn	nent.					

- 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		Forei	nsic B	iolog	y						
Course	code	23BSFS401R	Total credits:3	L	T	P	S	R	O/	F	С	
		23D3F340IK	Total hours: 45T	3	0	0	0	0	0		3	
Pre-requ	uisite	Nil	Co-requisite				N	Vil		·		
Prograi	mme		Bachelor of Science in Biotechnology									
Semes	ter		IV semester of firs	-			_					
Cour	se		nd the significance and r	eleva	nce o	f biolog	gical e	eviden	ce in c	rimir	nal	
Object	ives	investigations.										
			1 5									
		limitations. 3. Learn methods for the detection and analysis of bloodstains, including										
					alysis	s of blo	odsta	ıns, ınd	cluding	g		
CO	•		ve and confirmatory tes			1						
CO		•	ional understanding of									
CO2			es and techniques of DN				datain	matta	*** 0***0	Ivraia	and tha	
CO3	•		sis of bodily fluids, wit	па 10	cus ()II D100	ustain	parte	n ana	ıysıs	ana the	
CO		identification of blood group antigens. Investigate the role of entomology and anthropology in forensic investigations.										
CO	5	Understand the protocols and procedures involved in collecting, preserving, and analyzing biological evidence from crime scenes.										
Unit-		Con		Con		t Learning Outcom					KL	
No.				Но				-8				
I	Intro	duction to Forens	sic Biology: Overview	6		Unders	stand	ba	sics	of		
	of for	ensic biology: sco	ope, applications, and			forensi	ic biol	logy			1,2	
	histor	orical development,							1,2			
	legal	aspects and ethi	cal considerations in									
	forens	ic biology										
II	Princ	•	chniques of DNA	6		Explai	n th	e pri	nciple	of		
	Analy		cture and function			DNA p	orofili	ng usi	ng PC	R	1,2	
			olications, Techniques									
	in	DNA extracti										
***		fication (PCR), and	<u> </u>	0		E 1 .	.1		•	C		
III	1 -	· · · · · · · · · · · · · · · · · · ·	ids: Identification and	8		Explai					1,2	
			odily fluids (blood, tain pattern analysis:			detecti of bod			erpreta	ition	-,-	
	1	ples, methods, and	*			01 000	iiy iiu	ius				
IV			and Serology: Blood	8		Descib	e f	echnic	nies	for		
1 4			forensic significance,			blood			-	101	1,2	
		•	oup antigen testing and			orood (Sroup	actect	.1011.		-,-	
		gical analysis										
V		of Anthropology i	n Forensic	8		Discus	S		fore	nsic		
		t igations : Forensic				anthro	polog	y			1,2	
		fication of human				1						
	biolog	gical profiling, met	hods in skeletal									
	analys	sis and age estimat	ion, Crime scene									
	protoc	ols for biological	evidence collection									
	and pi	reservation										
•	•			•		•						

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 '	Title	7	Techno Professional Ski	ill – I	(Mu	shroon	n Cul	tivatio	n)				
Course	code	23BSBT224R	Total credits:2	L	T	P	S	R	O/F	C			
		25DSD1224K	Total hours: 30P	0	0	2	0	0	0	2			
Pre-requ	ıisite	Nil	Co-requisite	Nil									
Progran	nme		Bachelor of Sci	cience in Biotechnology									
Semes	ter		IV semester of fir	st yea	r of t	he pro	gram	me					
Cours	Course 1. To create awareness about the Mushroom among the people.												
Objectives 2. To strengthen the promotion of mushroom cultivation by establishing							ishing a w	ell-					
equipped laboratory and offices.													
			and explore the cultivat	ion in	Assa	m							
CO1		_	classes of mushroom.										
CO2		1	oduction and growth of n	nushr	oom.								
CO3		<u> </u>	m spawn production.										
CO 4			ods of cultivation of mu										
CO 5	5	Explain the tech	niques for the utilization	of mu	ıshroo	m spen	nt						
Unit-		Co	ntent		ıtact	Le	earnii	ng Out	tcome	KL			
No.				Н	our								
I		•	or mushroom cultivation;	6		_			trate the				
			tion of mother culture,			-		-	o harness 1,2				
			spawn; preparation and		mushroom cultivation								
		ation of mushrogement by vermicor	oom; mushroom spent										
	manaş	germent by verificor	ii posiiiig.										

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									

SEMESTER – IV													
Cour	se Title		Englis	h for Em	ployab	ility							
Cour	se code	23UBPD222R	Total credits: 2	L	T	P	S	R	O/F	C			
			Total hours: 32	0	0	2	0	0	0	2			
Pre-re	equisite	Nil	Co-requisite	:			N	il					
Progr	ramme		Bachelor of	Science i	n Biote	echnol	ogy						
Sem	ıester	Sp	ring/ IV semester	of second	l year (of the	progr	amme					
Co	urse	1. To develop	public speaking	skills, inc	cluding	scrip	t prep	aration	, understa	nding			
Obje	ectives	nonverbal c	nonverbal cues, overcoming fear, and practicing speaking strategies.										
		_	practical experien	ce in prep	aring,	submi	tting,	and sc	reening res	sumes			
		and cover letters.											
			nail etiquette, incl	uding the	structu	re of	emails	and e	ffective dr	afting			
		techniques.		_									
			students for int		hrough	prac	tice v	vith co	ommonly	asked			
			nd mock interview		,	1 ~	•.•		1 00 .				
	101		e conflict manager					• •					
	CO1	Enable students to p		ierstand no	onverba	al cues	s, over	come f	ear, and pi	actice			
	03	public speaking stra		1	1			. 1	1 . 44				
	02	Equip students with											
	O3 O4	Teach students the											
	U 4	Prepare students for in mock interview s		cucing co.	IIIIIIIIII	y aske	a ques	suons a	ina particij	paung			
C	O5	Students will under		of conflict	manaa	ement	ident	ify dif	forant type	c and			
	U3	analyze its effects.	stand the concept (or commet	manag	CITICIT	, ideiii	iry uiri	iciciii type	s, and			
Unit		Content		Contact		Laa	rnina	Outco	me	K			
-No.		Content		Hour		LCa	ımı	Outco	, iii C	L			
I	Public	Speaking Skills		11001	Stud	lents v	vill be	e able	to create				
_		ration of Scripts and	l understanding		effec			aking	scripts,				
	_	bal cues of Public S	-	_	inter	pret n	•	_	s, manage				
	ii. Und	erstanding and Over	coming Fear of	7		_			iety, and				
	Public	Speaking			prac	tice	effec	tive	speaking				
	ii. Prac	tice strategies of Pub	olic Speaking	techniques.									
II	Practic	eal session on Res	ume and Cover		Stud	lents	will p	repare	, submit,	3			
	letter				and	evalua	ate res	umes	and cover				
	_	aration, submission	& screening of	5	lette	rs.							
	Resume												
		tical session on cove	er letter screening										
	session												
III		Etiquettes	1.7.7	_				unders		1 ′			
		ferent Parts of Email	_	5					and draft	3			
117		fting emails effectiv	<u> </u>				tively.			2			
IV		ew Skills (Mock sess	*						common	1 1			
	1.Prepar	ring Commonly aske	a interview	7					onfidently				
	_	ons Interview sessions				perio views		WEII	in mock				
V								undara	stand the	2			
v	i. Defin	et Management							nagement,				
		ntion e of Conflict Manage	ement	8		_		nt ty	_				
		ects of Conflict Manage				-	effect	-	pes, and				
	111. 12116	ous of Commet Mall	igement		anal	y ZC IIS	CITCUL	a.					

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, 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 – V													
Course T	Γitle		Plant I	Biotec	hno	logy	,						
Course of	code	23BSBT311R	Total credits:4		L	T	P	S	R	O/F	C		
			Total hours: 45T+301	P 3	3	0	2	0	0	0	4		
Pre-requ		Nil	Co-requisite					N	il				
Program			Bachelor of Sci										
Semest			V semester of firs	_ •			rogr	amme	!				
Cours			1. Introduce tissue culture techniques and its applications										
Objecti	ves		2. To make the students understand about Somatic embryogenesis, somatic										
			hybridization, DNA transfer and Biotechnology for Crop Improvement 3. Develop skill on media preparation, and cell culture										
CO1			techniques and concep				e cul	ure.					
			t methods for transform						cells.	includi	ng their		
CO2			es and applications,			1		1	,		8		
CO3		1.	tic hybridization and a	ssocia	ted t	echn	iaues						
CO 4			thods of genetic engine				_						
		-	s of biotechnological a					orover	nent th	rough (genetic		
CO 5		engineering techno	-			. 510	ı1				J		
Unit-No.		Cont	<u> </u>	Cont	tact	Ι	Lear	ning (Outco	me	KL		
		Con		Ho		Learning Outcome							
I	Basic	techniques and t	cools in Plant Tissue	110		Γ	Descri	be Tiss	sue cult	ure			
	Cultur	e.				T	echn	iques			1,2		
	_	otency. Establishmer								1,2			
	lab:	equipment, culturation of various ex	re vessels Surface plants, pre-treatment of	10	0								
			repeated transfer of										
	_		Composition of various										
		culture media and	their preparation.										
			s, suspension cultures										
II	Somat		Introduction to the				Descri		g.				
	μ.		rganogenesis and their	9)	embryogenesis, organogenesis and					1,2		
	1		Somaclonal variations			somaclonal variation							
	andits												
TIT		uction of so	matic hybridization,				71		tio				
III		uction to	matic hybridization,					n soma ization			1,2		
	protop	olast isolation, Pri	inciples of protoplast	10	Λ	hybridization, protoplast isolation,							
	1		, Testing of viability of	10	U	c	ybrid	ization					
			arious steps in the										
	-	eration of protoplasts dization & Cyb											
	applic	•	deminion und										
IV	1		NA transfer-Direct						transf	er			
	genetr Partic	ansfer-	lment, Electroporation,			n	netho	ds			1,2		
			nification, Liposome	8	3						1,2		
	1		Mechanisms of DNA										
	1	_	ansfer-, Features of Ti										
		ti plasmids, Role											
X 7		lence genes Use of				Г	Zvnla:	n tha s	nnlicat	ion			
V		chnology for entional	Crop Improvement,						pplicat ogy for		1,2		
	metho	ds for crop in	nprovement, Pedegree	_ n	•			nprove			,		
			ing, Mutation breeding,	8	,								
	1	_	improvement. Crop										
Dugatical			ngineering, transgenesis lant root, Bio inoculant:	30	<u> </u>	Г)evele	n knor	vledge	on	1,2,		
Practical	1.511	ay or v Anvi Hom p	iant 100t, Dio moculant.	اد	U		CVCIC	יטווא אי	vicuge	OII	1,4,		

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	chno	logy					
Course c	ode	23BSBT312R	RSRT312R Total credits:4			P	S	R	O/F	C	
			Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-requi	isite	Nil	Co-requisite				Nil				
Program		Bachelor of Science in Biotechnology									
Semest	er	V semester of first year of the programme									
Cours			application of biotechnological						1 . 1		
Objectiv	ves		students understand about students understand about	ut gene	thera	apy, sten	n cells,	cance	r biolog	У	
			on handling human path	ogens	ΔFR	staining	method	l Ideni	tifving o	f	
			ng VDRL and Widaltests		ΑΙЪ	stanning	пстос	i, ideii	mymg o	,1	
CO1			on of medical biotechno		vithir	the rea	lm of r	nedica	al science	ce.	
CO2			ss of gene therapy.								
CO2			an introduction to ster	m cell	varie	eties, de	lve int	o the	origins	of stem	
CO3		cells, and outline t	heir distinctive characte	eristics	s.						
CO 4		Explore on cancer biology by shedding light on the predisposing factors that contribute									
004		to the development of cancer.									
CO 5		Elaborate on the mode of infection and infectious diseases.									
Unit-No.	No. Content			Cont		Learning Outcome K					
				Hou							
I	II .	duction to Medical b		10	10 Explain medical biotechnology					1,2	
II		es. Human Genome	on Genes Targeted for	9			ınv.	1, 2			
111	1	Therapy, introduction	on delies rangeled for	,	Describe gene therapy 1						
III			Types of Stem Cells,	10 Explain stem cell				1,			
	1		operties of Stem Cells			•		2, 3			
IV	Canc		troduction, Types of			Expla	in canc	er biol	ogy	1, 2,	
	1		ctors for cancer, Cellular	8						3	
	1	_	mor formation, Methods reatment of cancer –								
	1	motherapy and Radi									
V			Human – mode of			Expla	in infec	ctious		1, 2,	
			oidemiology and control			diseas				3,	
	1	easures, AIDS, Hepatitis – B, Rabies, HSV -			8						
		· · · · · · · · · · · · · · · · · · ·	nsmitted disease), TB,	0							
	Plague, Aspergillosis, Histoplsmosis,										
Practical		ptococcosis, Malaria	ım tuberculosis byAFB			Devel	lop kno	wledge	e on	1,2,	
Tractical	l l	ng method.	an tuociculosis byAi'D				cal biot	-		3,4	
		· ·	sease by using VDRL	30			_ 100		01	- 7 -	
		. 3.Study of Salmone									
	Wic	laltest									

- **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:

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						

SEMESTER – V											
Course	Title		Research Metho	dolog				d IPR	-		
Course	code	23BSBT313R	Total credits:3	L	T	P				C	
			Total hours: 45T	3	0	0 0 0			0	3	
Pre-requ		Nil	Nil Co-requisite Nil								
	Programme Bachelor of Science in Biotechnology										
Semes			V semester of th								
Cour		1. Describe research objectives, design, methodology, analysis including types of									
Object	ives	researches	IDD 1		•			.1 .1		1	
		2. Explain about IPR and ways of its protection along with the laws and regulations									
			with the process.		. 1	1	1		1 1'		
		_	ral and ethical issues a	ssocia	ted w	ith re	search	nes inc	cluding var	10US	
CO	1	conventions		1 .		41 1	1	1	· 1	1	
CO		-	rate research objectives		_	etnod	ology	, anai	ysis and re	search.	
CO2	<u>'</u>		ection and sampling m			1	٠,	1 41	1 1	1 4	
CO3	3		rights and ways of its	s prot	ection	ı alon	g wit	n the	iaws and	regulations	
CO		associated with th	-	المرزا	otic	L ma p	10.000 = -	ag of	htoinic = 41	hom	
CO			narks and geographical								
Unit-	<i>J</i>	Explain moral and Con	l ethical issues associat		tn res					KL	
No.		Con	tent	Ho		L	earm	ng Ou	tcome	KL	
I I	Introd	uction to Resea	arch Methods and	110		Evnla	in liter	rature	search, gap		
1			thesis and dissertation,			_			question,		
	Resea	••						ypothesis			
	Biblio	graphy, Literature s			design						
	resear	•				metho				1,2	
			nd Scientific methods,	10		1,2					
		ing the research Problem and Research									
	design	7 =									
	Gener Scient	ation and Evaluation, Various Steps in fic Research, Types of Research;									
		·	earch Design - Survey								
		rch –Case Study Res	•								
II			oling Design- Sources			Expla	in data	collec	tion an		
	of D	ata: Primary Da	ta, Secondary Data;			preser	ntation				
	Procee	`	•		9					1, 2	
	1 *	iments – Desig	•							,	
	1 -		Merits and Demerits -								
	Contro		Procedures – Sampling								
III			al Property - Concept			Descr	ibe IP	R, and			
111	1		, Patents etc., kinds			conve					
			Economic importance								
		of Intellectual Property. International Scen									
			leading international	10	0					1, 2, 3	
		_	intellectual property								
	rights:		onvention, Universal								
		_	e Paris Convention,								
	1	S, the World Intellectual Property Rights nization (WIPO) and the UNESCO									
IV		An Introduction to Trademarks and Explain trademarks, and GI									
1 1			ations - Registration of	,	3	LAPIA		VIIIUI K	., unu O1	1.2	
	Trademarks and Rights of Registered trademark			`	•					1, 2,	
		_	pellations of Origin,							3,	
L	1		1								

	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	tion		anag	ement				
Cours	e code	23FSZO501R	Total credits: 3	L	T	P	S	R	O/F	C	
			Total hours: 45T	3	0	0	0	0	0	3	
	quisite	Nil	Co-requisite				N	il			
Progr			Bachelor of Scie								
Semo			Fall/ V semester of the						• •	11 11:0	
Cou		1. To underst	and the ecological	princi	iples t	hat	form t	he ba	SIS OF V	vildlife	
Objec	ctives		n. rious techniques for ass	occin	a and n	aonit	oring H	ildlifa	hiodiver	itsz	
			hend the significance		_		_			•	
		species.	nend the significance	OI §	geneties	, 111	the co	iisci vai	lion of v	viidiiic	
			strategies for resolv	ing	conflict	ts be	etween	humar	activiti	es and	
		wildlife con	-	8							
		5. To gain kr	nowledge of the legal	land	l policy	y fra	mewor	ks gov	verning v	vildlife	
		conservation	-								
CO	D1	Explain ecological p	principles that underpin	wild	life con	serv	ation ef	forts.			
CC)2		ques for assessing and r			ildli	fe biodi	versity			
CC)3		genetics in wildlife con								
CC)4		ies for mitigating cor	iflicts	betwe	en l	numan	activiti	es and v	vildlife	
		conservation goals.									
CC)5		nd policy frameworks t	hat g							
Unit-		Con	tent		Conta		Learr	ning O	utcome	KL	
No.	El-		Wildlife Comment	•	Hour		T 1 4	1:	41		
I	1	-	Wildlife Conservat al principles, ecosys				Jnderst	_			
	l		ons, population dynan		10		fundamental ecological principles that support wildlife conservation.				
	l	t requirements, and l		nes,		^					
II			and Monitoring Wild	llife					cribe and		
	l	ersity:	w				apply various				
		•	on estimation techniq	ues,	8		echniqu	ies	for		
	1 -		ote sensing, and GIS				•		ssessment		
	l	e monitoring.	-				and mor	-			
III	Role o	f Genetics in Wildl	ife Conservation: Gen	etic		Ţ	Underst	anding	the role	;	
	l		ics, conservation genet		10			mporta		\perp 1 γ	
	-	-	gene flow, inbreeding depression, and genetics in wildl					wildlife	: 1,4		
	_	e management of sm					conserv				
IV	-	O	tween Human Activ	ities			•		elop and		
	l	Vildlife Conservatio		a			explain		egies to		
	l		nuses and impacts, con		10		nitigate		conflicts	± 1.2	
	l	-	nunity-based conservat	ion,			oetween		human		
	ana su	stainable developme	in practices.				activities and wildlife				
V	Legal	conservation. l and Policy Frameworks in Wildlife Knowledge of the legal									
•		rvation:	amendiks ill Will					•	meworks		
			and agreements, nation	onal	_		hat g	-	wildlife		
			rea management police		7		conserv			1,2	
	wildlife trade regulations, and enforcement						Conservation.				
	mecha	0	•								
										-1	

- 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						

		SEMESTE	R – V										
Course T	Title	,	Toxicolo	gy									
Course c	ode 23FSFS50		L	T	P	S	R	O/F	C				
		Total hours: 45T	3	0	0	0	0	0	3				
Pre-requ		Co-requisite				N	il						
Program		Bachelor of Science in Biotechnology											
Semest		Fall/V semester of											
Cours	_	ore the fundamental prin	•				_		•				
Objectiv		bution, metabolism, and	excretion	(AL)ME) c	of toxi	c subs	tances in	living				
	organ		.14:1	41		1	£	41 4	4:				
	_	ire proficiency in ana ification, and character	-		-				ection, ogical,				
		onmental, and occupational			toxic	Substa	ances	in biolo	ogicai,				
CO1		oundation of toxicological											
CO2	1 ^	rent types of toxicants.	principic	ъ.									
CO3		k associated with exposure	e to toxic	suhs	tances								
CO4		nechanism of absorption,				lism.	and ex	cretion of	toxic				
	_	thin the body.	213011001	,	111011100		UA		LOMIC				
CO5		ological knowledge to a	ssess an	d m	anage	risks	in env	rironmenta	ıl and				
	occupational	_	2222 411										
Unit-		Content	Conta	ct	Le	arning	Outc	ome	KL				
No.			Hour										
I	Introduction to T	Γoxicology:		E	Explain	the	fou	ındational					
	Definition	n and scope of		p	rinciple	es o	of to	xicology,					
	toxicolog	toxicology,				including the history and							
	History	and development of	10	d	levelop	evelopment of the field, the							
	toxicologi	ical principles,	10	d	lefinitio	n ai	nd so	cope of	1,2				
	Relations	hip between dose and			oxicolo		and						
	response					•	etween	dose and					
					esponse								
II	Classification of				•			types of					
		of toxicants: Chemical,			toxicants, understand their sources and routes of								
		l, and physical	8		ources	utes of	$\perp 1.2$						
	• Sources toxicants	and exposure routes of		- 1	•			cribe the					
		etics and toxic dynamics			nd toxi			kinetics					
III		and Management				•		ssociated					
111		s of risk assessment				exposu		o toxic					
	_	lentification and			ubstanc	•	by t	applying					
	characteri						•	sessment,					
		oonse assessment		1 ^	ncludin			hazard					
	_	assessment	10		dentific	_	dose	-response	1,2				
	_	Risk characterization and management			ssessm			exposure					
	managem				ssessm		and	_					
				c	haracte	rizatio	n	and					
				r	nanagei	ment.			<u></u>				
IV	Mechanisms of T	oxicity	Explain the mechanisms of										
	•	on of toxic substances	absorption, distribution,										
		on of toxic substances	10		metabolism, and excretion of 1								
		sm of toxic substances						ithin the					
	• Excretion	• Excretion of toxic substances				body, including the processes							

	• 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,	1.2	
	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	ini 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	Nil Co-requisite Nil										
Programme	Bachelor of Science in Biotechnology										
Semester	Fall/ V semester of third year of the programme										
Course		. Equip students with the essential skills and methods needed to conduct independent									
Objectives		research.									
	_	arch proposal, form	_		_			_	literature,		
		nd understanding the	_								
CO1		rafting a concise and				-		sal.			
CO2		research questions, o									
CO3		review of relevant lit							_		
CO4	_	data, draw meaning	ful conclu	ısıon	s, and	d rela	te res	ults to th	e research		
607	question.	C.1 . 1	C C 1	•		.1		C.1 .	•		
CO5	_	ness of the implication	ons of find	ıngs	Withi	n the	scope	of the mi	11		
Unit-No.	research.	44	Contact Learning Outcome KL								
Unit-No.	Content Contact Learning Outcome Hour					KL					
I	Crafting a concise a	and well-structured	Hour	De	evelor	n skil	ls in a	crafting a			
	research proposal, v		15					structured	1,2,3,4		
	research proposal on	-	10	research proposal.							
	Formulating Resear	•						research			
	Hypotheses in	small groups,		questions, objectives, and							
		ulated research	15	_	pothe		3		1,2,3,4		
	questions and hypotl	heses for feedback.			•						
III	Use of academic dat	abases and tools		Co	onduc	t a f	ocuse	d review			
	for literature review,	, conduct a	20	of	relev	ant li	teratu	re related	1 2 2 4		
	literature review on	the chosen	20	to	the c	hoser	n mini	research	1,2,3,4		
	research topic and su	ubmit a summary.		top	pic.						
IV	Hands-on practice	with data analysis		Le	earn to	inter	pret c	lata, draw			
	software, analyse sa	mple data sets and	10	me	eaning	gful	con	nclusions,	1,2,3,4		
	interpret the results.		10	an	d re	late	results	s to the	1,2,3,4		
				res	search	n ques	tion.				
1	Presentations and o				_			reness of			
	broader implication			the implications of findings							
	research findings,		10				ope of	f the mini	1,2,3,4		
	implications of the	-		res	search	1.					
	and submit a final re	esearch report.									

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)	Mapped Program Outcome						
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						

		SEMESTE	R – V											
Course Title		Techno profession	al skill	III (Analyti	cal Bi	ochemi	stry)						
Course code	23BSBT314R	Total credits: 2	L	T	P	S	R	O/F	С					
		Total hours: 60P	0	0	4	0	0	0	2					
Pre-requisite	Nil	Co-requisite		Nil										
Programme			Science in Biotechnology											
Semester				ear of the programme										
Course	1	•	_	nding of key concepts and techniques used in										
Objectives		uding buffer preparation		neasu	rement	, spect	rophoto	metry, er	nzyme					
	1	me activity modulation							22					
CO1		n how to prepare but		tions	which	coul	d be us	ed in di	fferent					
COA		chemical experiments.		C 1		1	C II							
CO2		derstanding on acid-ba	_				_		1					
CO3	spectrophotomete	principle of Lamber	ı-Beer i	aw	viin ir	ie nei	p or c	olorimete	er and					
CO4		echanism of enzyme k	inetics a	nnlvi	na Mic	naelic	Menten	equation						
CO5		ept of enzyme activity			ing ivite	ilaciis	IVICIICII	equation	•					
Unit-No.		entent	Contact Learning Outcome KL											
			Hour											
I	 Measure t solutions us Prepare ti titrating acid Determine to by analysing Measure different s wavelength standard cur Perform e measure different concentration Investigate 	olutions at specific s and prepare rves. enzyme assays to reaction rates at substrate ons. the effects of hibitors (competitive,	30	t i r s k	ssentia echniqu ncludin H pectrop	les g buf hotom and	biocland confer prepresentation biochemical biochemica	hts into hemistry oncepts, paration, urement, enzyme activity	3,4					

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						

SEMESTER – VI														
Course Tit	tle				Ani	mal Biot	ech	nology						
Course co	de 2	3BSBT321F	Į.	Total credi			L	T	P	S	R	O/F	י	C
]	Total hours			3	0	2	0	0	0		4
Pre-requis		Nil			equisite					Ni	l			
Programn		Bachelor of Science in Biotechnology												
Semester	r	VI semester of third year of the programme												
Course				nimal Cell		_								
Objective	es	2. Elucidation of various cell to cell interaction; adhesion, motility and metabolic										bolic		
		co-operation. 3 Impart skills on tools and techniques used for animal cell culture												
CO1	Evr	3. Impart skills on tools and techniques used for animal cell culture. Explain the evolution of animal cell culture.												
CO2		scribe the ap					re te	echnolo	ov v	vith	snecia	1 refe	ren	ce to
CO2	I	cines and pr					ic ii	Cilliolo	gy v	VILII	зреста	i icic	1011	
CO3		strate on ass			•		d ba	sics of l	huma	an fe	rtilizat	ion pi	000	ess.
CO4		scribe the ov										r-		
CO5		olain DNA fo		_				_	n ce	ll res	earch	and b	io	
		cessing Tecl			C	ŕ		<u>.</u>						
Unit-No.	o. Content					Contact		Lear	ning	Out	come		K	L
						Hour								
I	1	ction, histo	•					escribe			of			
	culture.Basic requirement for animal cell						an	imal ce	ll cu	lture				
		Animal ce			- 1	10							1	,2
		s, Primary c	•											
	culture,				lines,									
	1 -	sion culture			-									
	hybridi: Growth			ultures,Scal Cellline	and									
		nance, viabil												
II	Applica			l culture	icity		D	escribe	the c	-e11		_		
11	1 ^ ^	ogy in produ				9		lture	ar		vaco	rine	1	, 2
		<i>- - - - - - - - - -</i>		it vaccines	and			oductio		14	vacc			, -
	pharma	ceutical prot					P	0 00000						
III	Structu		perm		ovum,		Ех	xplain re	epro	ducti	ve	+		
		eservation of	•			10		ructures		nd	artifi	cial	1,	2,
		cks, IVF, su	•				fe	rtilizatio	on					3
	fertiliza		ture		nbryos,									
	cryopre	eservation o	of e	mbryos, e	mbryo									
	transfer	<u>. </u>												
IV	Gene	therapy:		verview,				kplain tl	_	_				
		•		es, applic		8		cell	cult	ure	in g	ene		2,
		iges and d		_			th	erapy					3	3,
	1 -	ering overvi		_										
T 7		cell nucleus					 	1 .	11 1	. cc	<u>,. ,.</u>			
\mathbf{V}		ell differentiation during development d role of homeotic genes and other						kplain c						•
				-		0		derstan	_	_	plicati	ons		2,
	_	•	genes	•	attern	8	ın	various	tiel	ds			3	3,
	formati	,	•		uman									
		es, bio-terro	_											
		o-terrorism, o			auon									
	on anın	nal biotechno	olog	y.										

Practical	 Laboratory safety Setting of Animal cell culturelab 		Develop knowledge on animal cell culture and	
	3. Field visit to animal cell culture laboratory	30	laboratory	1,2, 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:

 $\underline{https://books.google.com/books?hl=en\&lr=\&id=K8eaAgAAQBAJ\&oi=fnd\&pg=PA1\&dq=animal+biotec}$ 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						

		SEMESTER	R – VI									
Course Title		Industria	al Biotec	hnolog	gy							
Course code	23BSBT322R	Total credits: 4				S	R	O/F	C			
		Total hours: 45T+	30P	3 (2	0	0	0	4			
Pre-requisit		Co-requisite				Nil						
Programme	;	Bachelor of Science in Biotechnology										
Semester		VI semester of thi										
Course		8 8										
Objectives		student understand					_	_				
		reactor production of	-	_								
	SCP.	d, Antibiotics-Penici	IIIIn, Sol	vent-E	thanoi,	V itam	ıns-Kı	bollavi	n and			
		ll on Immobilizatio	a atradar	hv. a.	مسناه	lainat		thad (vacat)			
	_	of bioinoculant, prod	-	-		ngmai	e me	moa (yeasi),			
CO1	_	cal evolution of fe				10 ke	ev mi	ilestone	es and			
COI		e understanding and a				_	•		o and			
CO2		tion of media in the c							delve			
		ation techniques empl					•					
	such as microbiolog			F								
CO3		design and function	ality of b	ioreact	tors, deta	iling	the ke	y comp	onents			
	and principals invol	ved in creating contro	olled env	ironme	nts for b	iologi	cal pro	ocesses				
CO4	Describe the proces	s of producing micro	bial prod	lucts, c	outlining	the k	ey step	os invo	lved in			
	cultivating and harv	esting microorganism	ns to obta	in desi	red prod	ucts.						
CO5	To explain about Bi	ofertilizers, biopestic	ides, and	mushr	oom tec	hnolog	gy rep	resent				
	sustainable and env	ironmentally friendly	approac	nes in a	agricultu	re.						
Unit-No.	Cont	tent	Contac	t 1	Learning	g Out	come		KL			
_			Hour	_								
I	Historical developme		10		ribe use		1 .		1.0			
	-	ream processing.						7	1,2			
	Screening of indumicrobes. Strain impr	ustrially important										
	development	iovement, moculum										
II	Media formulation, s	terilization batch		Desc	ribe cult	lire ar	nd					
	and continuous cultur		9		th kineti		IG		1, 2			
	fermentation, Stoichi			8					-, -			
	growth and kinetics.											
	immobilization											
III	Biorector- Design,	parts and their		Expl	ain biore	actor						
	function. Types of	bioreactor-cstr. Air	10					-	1, 2,			
	lift, Bubble column,	Packed bed, Tower,							3			
	monitoring and co	_										
	variables (Temperatu											
IV		icrobial products:	_		ain prod							
	Enzymes- amylase,	-	8	1	mes, ant	ıbiotic	es,		1, 2,			
	acid, Amino acid	-		ethai	nol etc.				3,			
	Antibiotics-Penicillin											
V	Vitamins-Riboflavin			D 1	oin 41 1	: - f '	1:		1 2			
v	Biofertilizers, Biopes		8	_		n the biofertilizers, 1, 2, icides etc. 3,						
	technology, Vermited technology, Biodyes,		ø	biole	sucides	eic.			3,			
Practical	1. Immobilization			Deve	elop kno	wleda	e on					
1 i acticai	1. IIIIIIOUIIIZatioii	i study by soululli		Deve	лор кио	wieug	COII					

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	
2	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	Title		Hei	bal Med	dicin	ie						
Course c	ode	23FSBO601R	Total credits: 3	L	T		S	R	O/F	C		
		2702	Total hours: 45T	3	0	0	0	0	0	3		
Pre-requi		Nil	1									
Program Semest		C	Bachelor of Science in Biotechnology Spring/ VI semester of third year of the programme									
Cours		To understand the pharmacological properties of medicinal plants.										
Objectiv		 To understand the pharmacological properties of medicinal plants. To learn the methods of formulation of herbal medicine. 										
3.23		3. To evaluate scientific literature on herbal medicine.										
		4. To discuss the clinical applications of herbal medicine.										
			o comprehend the legal and ethical issues related to herbal medicine.									
CO1			ogical properties of n									
CO2		_	ls of formulation of h literature on herbal m			ne.						
CO3			olications of herbal m									
CO5		1	al and ethical issues of			dicine.						
Unit-		Conte		Contac			arning	g Outc	ome	KL		
No.				Hour	•							
I		rmacological	Properties of						cological			
		dicinal Plants:	Introduction to						anisms of	1.0		
	_		tive compounds in action, examples of	9		action of in medic			ompounds	1,2		
	1 ~	monly used medici	-			III IIICUIC	mai p	ianis.				
II			lation of Herbal			Demons	trate	know	edge of			
	Med	dicine: Extraction n	nethods, preparation			different	t ex	ktractio	on and			
	of	extracts, formu	9		formulation techniques used in herbal medicine.							
		ctures, decoctions,										
	_	sules), standardiz ducts.	ration of herbal									
III	1		ic Literature on	9	e and							
		bal Medicine:	e Encruture on				•					
	Res	earch methodologie	s, critical appraisal			related to				4,5		
	of c	linical studies, syste	ematic reviews,									
		a-analyses, interpre				D .		_	4			
IV		A A	ns of Herbal	9								
			in treating common						•			
			-			-				3,4		
		fety and efficacy, interaction with					8					
		ventional medicines										
V	_		Issues in Herbal	9					scuss the			
			sa analite contact			-						
	_	· ·				to the practice and research of herbal medicine.						
		1 1 2	-			ncivai II	iculcii.	ic.				
		ent consent.	,									
IV	Eva Her Res of c met Clir Mee use ailm safe com Leg Mee Reg inte	cluation of Scientific bal Medicine: earch methodologie linical studies, systema-analyses, interpresional Application dicine: of herbal medicinements, evidence-bety and efficacy, eventional medicines al and Ethical dicine: culatory framework ellectual property siderations in research	es, critical appraisal ematic reviews, tation of results. Ins of Herbal in treating common ased applications, interaction with s. Issues in Herbal as, quality control,	9		Discuss applicati efficacy in treatir Understategal and to the property of the	t scie o herb tions, of head and a d ethic ractice	the safet erbal is ous co	clinical y, and medicines nditions.			

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 – VI										
Course T	itle		Comm	unity N	utri	tion					
Course c	ode	23FSFD601R	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				N	il			
Program			Bachelor of So								
Semest			oring/ VI semester o								
Cours		l .	and the principles and	_			nal ep	idemio	ology.		
Objectiv	ves		ne nutritional needs o								
		_	ent and evaluate com	-			-		,		
			and the role of ad	vocacy	ana	policy	aevei	opmer	it in impi	roving	
		community 5. To develop		za mutniti	on 0	duantin	n and i	intomio	ntion nroo	************	
CO1		_	strategies for effectives and practices of nu					merve	nuon prog	rams.	
CO2			nutrition needs using		_			odolo	niec		
CO2		·	uate community nutr				u men	iouoio	gies.		
CO3			ly advocacy and poli	_	_		nnrov	e comr	nunity nut	rition	
CO5			nent effective nutrition							11110111.	
Unit-		Conte		Contac				g Outc	-	KL	
No.				Hour				,			
I	Nut	ritional Epidemiol	ogy]	Explain	the	princi	ples and		
		• Principles	of nutritional			practices			utritional		
		epidemiology				epidemi	ology.				
		• Study design	s in nutritional	9						1,2	
		epidemiology		9						1,2	
		 Measurement o 	•								
			arkers in nutritional								
		epidemiology									
II	Cor	nmunity Nutrition						•	nutrition		
			sessing community				•		riate tools		
		nutrition needs			1	and met	nodolo	ogies.			
		• Dietary survey status assessme	s and nutritional	9						2,3	
		 Use of 	anthropometry,								
		biochemical, an									
		• Interpretation o									
III	Cor	nmunity Nutrition		9		Impleme	ent	and	evaluate		
		 Planning and in 				commur			nutrition		
		nutrition progra	•			program	•				
		 Monitoring and 			1						
		nutrition progra								3,4	
		• Case studies of									
		community nut									
	Challenges in implementing										
		nutrition progra									
IV	Adv	ocacy and Policy I	_	9							
			acy in community								
		nutrition								3,4	
		Policy developm	-							- , .	
		~	nfluencing 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		
	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 T	Title			Natural P	roduc	t Ch	emistr	y			
Course c	ode	CCIICA1D	Total cree	dits:3	L	T	P	S	R	O/F	С
	23F)	SCH601R	Total hour	rs: 45T	3	0	0	0	0	0	3
Pre-requ	isite	Nil	Co-re	quisite			1	ľ	Vil	1	•
Program	nme	Bachelor of Science in Biotechnology									
Semest	er	VI semester of first year of the programme									
Cours		1. To provide students with an understanding of the chemistry of natural products.									
Objectiv	ves 2.	2. To familiarize students with the structural diversity, biosynthesis, and biological									
		activities of natural products.									
	3.	3. To impart knowledge about the extraction, isolation, and structural elucidation of natural products.									
CO1	Danas				:£: 4:		£		1		
CO1				es and class oathways of					•		
CO2				the extraction		-					
CO 4	_			ctural elucid						raucis.	
CO 5	11 2			ies and phari						al produc	ets.
Unit-	21300	Cont			Con					tcome	KL
No.					Но				0		
I	Introduction	on to	Natural	Products:	10	0	Classi	fy Nat	tural P	roducts	1,2
	Definition	and sign	ificance of	of natural							
	-	Classification		-							
	Primary		•	netabolites.							
		of natural pr		-							
77		isms, and m					Explai	ъ.	.1	<i>.</i> •	1.0
II	Biosynthes Biosyntheti		Natural iys: Prim	Products: nary and	9	etic	1, 2				
	•	metabolisi	•	•			Pathwa	ays			
	•	cetate path	*								
	non-mevalo	_	athways.	Alkaloid							
	biosynthesi	_	•								
III	Extraction	and Iso	olation of	f Natural	10	0	Utilize	Extra	action	and	1,
	Products						Isolati	on Te	chniqu	ies	2, 3
		techniques									
		illation, an	•								
	extraction.,			techniques:							
				C, HPLC,							
137	Structural	cation techn Elucida	•	Natural	-		Flucia	oto St	miotro	as Hains	1.2
IV		Spectroscop			8	2	Spectr			es Using	1, 2,
		Spectroscop Mass Sp			°	,	Specif	oscop	TO IVIE	uious	3
	determinati	_	erpenoids,	alkaloids,							
flavonoids, and steroids.											
V		Products:			Evalua	te Bio	ologica	al	1, 2,		
	_	Antibacterial, antifungal, antiviral, a					Activi		٥		3,
	anticancer	activities.	Natural p	roducts as	8	3					
	therapeutic	agents.			L						

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										
Semester Fall/ V semester of third year of the programme												
Course		1. Equip students with the essential skills and methods needed to conduct independent										
Objectives		research.										
	_	arch proposal, form	_		_			_	iterature,			
		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	·	. 1	1							
CO5		onduct and Contribu					<u> </u>		TZT			
Unit-No.	Cont	tent	Contac Hour	et	Lea	arnın	g Out	come	KL			
I	Crafting a concise a	and wall structured	поиг	D	ovala.	n alail	la in a	crafting a				
	research proposal, v		15			1,2,3,4						
1	research proposal on	-	13	5 concise and well-structured research proposal.					1,2,3,4			
	Formulating Resear							research				
	Hypotheses in	small groups,						ves, and				
	• •	ulated research			hypotheses.		,	1,2,3,4				
	questions and hypotl			'	/ 1							
	Use of academic dat			С	onduc	t a f	focuse	d review				
	for literature review,	conduct a	20	of	f relev	ant li	teratu	re related	1 2 2 4			
	literature review on	the chosen	20	to	the c	chosei	n mini	research	1,2,3,4			
	research topic and su	ıbmit a summary.		to	pic.							
IV	Hands-on practice	with data analysis		L	earn to	o inte	rpret d	ata, draw				
	software, analyse sa	mple data sets and	10		eanin	_		nclusions,	1,2,3,4			
	interpret the results.		10	aı	nd re	late	results	s to the	1,2,3,4			
					esearcl							
	Presentations and o							eness of				
	broader implication				•			findings				
	research findings,		10				ope of	the mini	1,2,3,4			
	implications of the	_	research.									
	and submit a final re	search report.										

Reference Books:

R1. Creswell; Research Design: Qualitative, Quantitative, and Mixed Methods Approaches; 5^{th} 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)	Mapped Program Outcome
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 – VI Course Title Techno-professional skill IV (Food packaging technology)												
										1			
Course c	ode	23BSBT323R	Total credits: 2	L	T	P	S	R	O/F	C			
D	• • .	3.701	Total hours: 60P	0	0	2	0	0	0	2			
Pre-requ		Nil	Co-requisite	<u>. </u>	D.		N	il					
Program		Bachelor of Science in Biotechnology											
Semest			Spring/ VI semester of third year of the programme 1. Understand the principles and practices of food packaging technology,										
Cours Objectiv			importance, function			•			•••	le and			
Objectiv	ves	systems.	importance, runction	ns, and a	avai	CCITICIT	s in po	ackagn	ing materia	is and			
		· ·	ledge of different	packagi	ing	materia	ls, sy	stems	for fresh	and			
			ood groups, and emen		_		-						
CO1		-	nce, functions, needs										
CO2			different types of pac										
CO3		Describe various for	od packaging system	s and pro	ocess	differe	nt form	ns of p	ackaging.				
CO4			od packaging system			d proce	ss foo	d group	ps.				
CO5			ements in the field o										
Unit-		Conte	nt	Contac		Lea	arning	g Outc	ome	KL			
No.				Hour									
I			ood Packaging:			Students			able to				
	_	ortance, functions,			nalyze			historical					
	_	kaging, historical			•			olution of	1,2				
	evoi	lution of food packa	ging.	6		_	1 0 0						
						ey nnoveti			e shaped				
					- 1	movan he field		iai nav	e snapeu				
II	Pac	kaging Materia	ls: Types of			Students		l be	able to				
		kaging materials,	J1			valuate		prop					
	Prop	perties and suitabi	lity for different		d	lifferent	pack	aging	materials				
	food	d products	6	a	nd justi	ify the	ir suita	ability for	2.2				
				0	s	pecific	typ	es c	of food	2,3			
				ŗ	roducts	bas	sed o	on their					
								sical, a	nd barrier				
						ropertie							
III		d Packaging Syste		6					able to				
	^	kaging systems, Pr	•		1 ^	-			roject for				
		tertiary packagin				resh	food	p p	ackaging,				
		h and processed ems for fresh food				onsider econda	_	and	primary,	2.4			
		siderations, design p				ackagir	•	and needs	tertiary and	3,4			
		h food packaging, s			^	ncorpor	_		egies for				
		miques.	men-me extension		- 1	helf-life	_		extension				
						echniqu			-Aconsion				
IV	Sus	tainable Packaging		6				oe able	to assess				
		nds and advanceme	current trends					and	_				
	pacl	kaging, role and ber	nefits of active and		a	dvance	ments	in st	ustainable				
	_	lligent packaging, a		r	ackagir	ng, inc	cluding	g the role	2 1				
	pres	servation and safety.			a	nd bei	nefits	of ac	ctive and	3,4			
						ntellige		1	packaging				
						echnolo	_		enhancing				
					f	ood pre	servat	ion and	d safety.				

Packaging Regulations and Safety:	6	Students will be able to	
regulatory requirements for food		explain regulatory	
packaging, food safety considerations in		requirements for food	
packaging design, packaging innovations		packaging and integrate food	
and future trends, emerging technologies		safety considerations into the	1.5
and future trends in food packaging.		design and development of	4,5
		packaging solutions, while	
		also discussing emerging	
		technologies and future trends	
		shaping the field.	
	regulatory requirements for food packaging, food safety considerations in packaging design, packaging innovations and future trends, emerging technologies	regulatory requirements for food packaging, food safety considerations in packaging design, packaging innovations and future trends, emerging technologies	regulatory requirements for food packaging, food safety considerations in packaging design, packaging innovations and future trends, emerging technologies and future trends in food packaging. 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

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

Master of Science

in

Microbiology

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 15th & 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28th July, 2023.

Chairperson, Board of Studies

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

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: 97

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 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.

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.

Breakdown of Credits

Sl. No	Category		Total number of Credits
		Skill Enhancement Course (SEC)	0
		Ability Enhancement Course (AEC)	0
1	University Core(UC)	Field Training	0
		Discipline Specific Elective (DSE)	0
		Value Added Course (VAC)	2
2	University Elective (UE)	Multidisciplinary Course (MDC)	0
2	Offiversity Elective (OE)	Value Added Course (VAC)	13
		Discipline Specific Core (DSC)	27
3	Program Core(PC)	Field Training	0
3	r Togram Core(rC)	Research /Industry Internship	27
		Summer Internship	0
4	Program Elective (PE)	Discipline Specific Elective (DSE)	18
4	1 logram Elective (1 E)	Value Added Course (VAC)	0
5	Faculty Core(FC)	Skill Enhancement Course (SEC)	4
<i>J</i>	racuity Core(rC)	Ability Enhancement Course (AEC)	6
		Total	97

Breakdown by categories of courses

Sl. No.	Category	Credits	%
1	Science	90	92.78%
2	Humanities and Social Sciences	6	6.19%
3	Commerce and Management	1	1.03%
	Total	97	100%

SEMESTER WISE COURSE DISTRIBUTION

	S.N.	Course Code	Course Title	Course]	Enga	age	men	ıt		Ma	aximum	Marks	s for
	5.11.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
			Introduction to												
	1.	23MSMB111R	Microbiology & Microbial Diversity	DSC	3	0	2	0	0	0	4	40	60	100	200
	2.	23MSMB112R	Microbial Genetics and Physiology	DSC	3	0	2	0	0	0	4	40	60	100	200
erI	3.	23MSMB113R	Biochemistry	DSC	3	0	2	0	0	0	4	40	60	100	200
Semester I	4.	23MSMB114R	Bioinstrumentation	DSC	3	0	2	0	0	0	4	40	60	100	200
S	5.	23MSCE111R	MOOCS –I	VAC	0	0	0	4	0	0	2	0	100		100
	6.	23UMFS111R	Fundamental of Statistics	Research	2	0	2	0	0	0	3	40	60	100	200
	7.	23MSMB115R	Mini Research - R1	Research	0	0	0	4	8	0	2	0	0	100	100
	8.	23UMPD111R	PDP: Effective English	AEC	0	0	4	0	0	0	2	0	0	100	100
		Total	_								25				1300

	S.N.	Course Code	Course			Eng	age	men	t		Ma	ximum	Marks	for	
	3.IV.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23MSMB121R	Immunology	DSC	3	0	2	0	0	0	4	40	60	100	200
	2.	23MSMB122R	Molecular Biology, Genomics and Genetic Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	3.	23MSMB123R	Bioinformatics	DSC	2	0	2	0	0	0	3	40	60	100	200
	4.	23MSMB124R	Mushroom Cultivation: Techno- ProfessionalSkill 1	SEC	0	0	4	0	0	0	2	0	0	100	100
er II	5.	23MSMB12R	Generic Elective: Public health and Hygiene	VAC	2	0	0	0	0	0	2	40	60	0	100
Semester II	6.	23MSCE121R	MOOCS -II	VAC	0	0	0	0	0	0	2	0	100	0	100
Š	7.	23UMRM121R	Research Methodology and Statistical Analysis	Research	1	0	0	4	0	0	2	40	60	0	100
	8.	23MSMB126R	Mini Research 2 (Research gap Analysis-R2)	Research	0	0	0	4	12		3	0	0	100	100
	9.	23UUHV101R	Universal Human Values and Professional Ethics	VAC	1	0	2	0	0	0	2	40	60	100	200
	10.	23UMPD121R	PDP: Communication Mastery	AEC	0	0	4	0	0	0	2	0	0	100	100
		Tot	tal								26				1400

	S.N.	Course Code	Course Title	Course			Eng		eme	nt			imum		s for
	D.11.	Course Coue		Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23MSMB211R	Bio-fertilizer Production: (Techno- Professional Skill- II)	SEC	0	0	4	0	0	0	2	0	0	100	100
	2.	23MSMB212R	Generic Elective -Public health and Hygiene	VAC	2	0	0	0	0	0	2	40	60	0	100
	3.	23MSCE211R	MOOCS-III	VAC	0	0	0	0	0	0	2	0	100	0	100
	4.	23MSCE212R	MOOCS-IV	VAC	0	0	0	0	0	0	2	0	100	0	100
	5.	23UMRE214R	Research Ethics	Research /Industry Internship	0	0	2	0	0	0	1	0	0	100	100
Semester III	6.	23MSMB213R	Mini Research – (Survey/Experiments - R3)	Research /Industry Internship	0	0	6	4	0	0	4			100	100
nest	7.	23UMPD211R	DP: Corporate Proficiency	AEC	0	0	4	0	0	0	2	0	0	100	100
Sen	8.	23UUFL202R	Personal Financial Planning	VAC	0	0	2	0	0	0	1	0	0	100	100
	Discipline specific Elective (Any						ojec	ts t	o be	e sele	ected	l)			
	9.	23MSMB214R	MSMB214R Medical Microbiology			0	2	0	0	0	4	40	60	100	200
	10.	23MSMB215R	Microbial Ecologyand EnvironmentalMicrobiology	DSE	3	0	2	0	0	0	4	40	60	100	200
	11.	23MSMB216R	Soil and Agricultural Microbiology	DSE	3	0	2	0	0	0	4	40	60	100	200
	12.	23MSMB217R	Clinical and Diagnostic Microbiology	DSE	3	0	2	0	0	0	4	40	60	100	200
	13.	23MSMB218R	Organic Farming	DSE	3	0	2	0	0	0	4	40	60	100	200
			Total								28				1400
	S.N.	Course Code	Course Title	Course					eme		-		imum		
	1.	23MSMB221R	Research/ Data analysis/ Documentation -R4	Research	0		20		R	0	C 12	0	0 0	200	Total 200
			Discipline specific Elec	tive (Any t	wo s	sub	ject	s to	be	sele	cted))			
r IV	2.	23MSMB222R	Industrial Microbiology and Fermentation Technology	DSE	2	0	2	0	0	0	3	40	60	100	200
Semester IV	3.	23MSMB223R	Food and Dairy Microbiology	DSE	2	0	2	0	0	0	3	40	60	100	200
S	4.	23MSMB224R	Pharmaceutical Microbiology	DSE	2	0	2	0	0	0	3	40	60	100	200
	5.	23MSMB225R	3MSMB225R Marin Microbiology			0	2	0	0	0	3	40	60	100	200
	Total:										18				600
		Total	for all four Semesters:								97				4700

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

	SEMESTER – I										
Cours	se Title		n to Microbiolo	gy & Micro							1
Cours	se Code	73MSMR111R	tal credits: 4 tal hours: 45T	±30P	L T 3 0		0			O/F 0	C 4
Pre-re	equisite	Nil	Co-requis		3 0			Ni	_	U	
	amme	Ma	ster of Science		ology						
Semes	ster	Fall/ I sen	nester of first y	ear of the l	Progra	mm	e				
		1. To familiarize the student						o pr	oka	ryotic	and
	ourse ectives	eukaryotic cells.2. To emphasize on distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification.3.To study the structure, function, diversity of microorganisms in different habitats, ecosystem, and microbial associations, microbial interactions									
C	CO1	Describe the fundamental classification of microorga organelles.	nisms, microso	copy, and	structi	ure	of	pro	okar	ryotic	cell
C	CO2	Demonstrate different sterilizand staining techniques	zation technique	es, applicati	ion of	micr	rob	ial c	cult	ure me	edia,
C	203	Explore microbial diversity space.	in different hab	oitats includ	ling ex	trem	ne	envi	ron	ments	and
C	CO4	Apply the microorganisms for	r Bioleaching, b	oioremediati	on, and	d bio	de	eterio	orat	ion.	
C	CO5	Explain microbial indicators cycles.	of wastewater,	microbial in	nteract	ions,	an	nd bi	ioge	eochem	nical
Unit No.		Content	Contact Hour	Learı	ning O	utco	me	9		KI	1
I	spontar disease Leeuwe Koch, Fleming The Fiv domain Microse Prokary plasma membra	rof microbiology: Theory of neous generation, germ theory of neous generation, germ theory of neous generation of Antony versions. Louis Pasture, Robert Edward Jenner, Alexander, The Three Kingdom Concerve Kingdom concept and the three concept. Loopy: Principle of microscopy, rotic cell, Bacterial cell we membrane, capsule, our membrane, capsule, our membrane, rimbriae, pin, endospore, ribosome, inclusive.	Van pert der ept, ee- all, atter	Summarize vents in of microb of key con Explain functionin Describe function of componer	the opiology ntribute the pag of me the stood prob	devel and ors. rincip nicrostructu	lop the ple sco	men e role an opes.	e and a d	1,2,	3
II	& Med- of ste Simple Structu anaerol culture Technic Enricht Preserv culture.	oic culture. Concept of mix and pure culture. ques of pure culture isolation ment culture technique ation, and maintenance of pro-	ods ue: ng, and ked on, aes, ure	Apply sterilization various in and equip Explain in application staining to Understain mixed con cultures isolate pu Define in	microboment. the prions of echnique the ultures and of the cultive cul	incipion dincipion di	ods cul les diff ncep d	and eren pt o pure	or es d d at of ee o	1,2,3	3,4

	of different types of media, basal media, differential media, selective media, transport media. Cultural & Unculturable microbes: Culture- dependent approaches for diversity study and their limitations, Exploration of Un-culturable bacteria: Culture independent molecular methods for identifying uncultivable bacteria, metagenome concept		the different types. Explore culture dependent and culture independent methods for study of microorganisms.	
III	Environmental microbiology & Diversity: Concept of microbial ecology, Diversity of microbes in terrestrial (agricultural and desert soil), aquatic (fresh water and marine water) and animal (cattle, termite and human being), Microbes in extreme environments — thermophiles, psychrophiles, barophiles, acidophiles, alkaliphiles and halophiles, organic solvent and radiation tolerant, and theirpotential applications. Microbiology of air and space.	10	Explain the concept of microbial ecology and the interactions between microorganisms and their environments. Identify and describe the diversity of microbes. Describe the characteristics and adaptations of extremophiles. Explain the presence and significance of microorganisms in the air and space.	1,2,3,4,5
IV	Bioleaching – copper, gold and uranium, Microbial degradation of xenobiotics – petroleum, oil spills, biomagnifications. Bioremediation- in-situ and ex-situ, Biodeterioration- paper, textile, wood, metal, Corrosion: – methods of protection	10	Discuss the microbial mechanisms involved in bioleaching. Describe the microbial processes involved in the degradation of xenobiotics. Understand the concept of bio magnifycation and its environmental implications. Differentiate in-situ and exsitu bioremediation techniques. Explain the microbial causes of bio deterioration. Understand the microbial role in corrosion and methods for its prevention.	2,3,5
V	Wastewater treatment, Bacterial indicators – DO, BOD, COD, water purification; Microbial interaction: Competition, ammensalism, parasitism, mutualism, commensalism, synergism, Biogeochemical cycles – Carbon, Nitrogen, Phosphorus	7	Explain the stages of wastewater treatment. Understand the importance and function of bacterial indicators such as DO, BOD, and COD. Identify and explain different types of microbial interactions. Explain the roles of microbes in the Biogeochemical Cycles.	1,2,3,4.5

	1. Study of effective Sterilization by	30	Proficiency in various	1,2,3,4,5,6
	physical and chemical method		biochemical tests, isolation	
	2. Preparation of bacterial smear and		and staining techniques for	
	staining (Simple, Grams, negative and		bacterial and fungal	
	acid fast)		identification.	
	3. Preparation of culture media,			
	Measurement of pH			
ਬ	4. Isolation of pure culture – serial			
Practical	dilution, Pour plate Technique, spread			
Lac	plate technique, types of streaking.			
P	5. Fungal staining: KOH Mounting,			
	LPCB			
	6. Isolation of air microbes by gravity			
	settle method			
	7. Study of Biochemical test: IMViC,			
	Starch hydrolysis test, catalase test,			
	Oxidase test			
	8. Bacteriological examination of water			

- 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							

		SEMI	ESTER – I								
Cours	se Title	Microb	oial Genetics and	Physiology							
Cours	se code	74//5///1811712	Total credits: 4 Total hours: 45T-	+30P	L T P 3 0 2	S R 0	O/F C 0 4				
Pre-r	equisite	Nil	Co-requisi			Nil					
Progr	ramme	Master	r of Science in Mi	crobiology							
Seme	ster	Fall/ I semest	ter of first year of	the Progr	amme						
Obj	ourse ectives	 To teach the biological production variability of genetic material. To discuss the application of engineering techniques in orders. To study the structure, further mechanisms of microorganisms. Discuss the historical prospect and	of the knowledge r to produce strain nction, energy n s.	of microbs applicable	oial genetic e in biotechi growth a	es and nology. and reg	genetic				
C	and gene transfer mechanisms. Describe plasmids, bacteriophage life cycles, DNA mutation, damage, and replication including detection techniques like the Ames test and replication platting. Describe generated code, RNA types, and structure; its role in protein synthesis. Analyze the mechanism of transcription and translation, associated enzymes and fact										
C	203	and the regulation of gene express	-	ussoci		eos una					
C	CO4	Explain bacterial and fungal grow	th kinetics and cel	l cycle.							
C	CO5	Explore microbial response to env	vironmental challer	nges							
Unit No.		Content	Contact Hour	Learn	ing Outcon	ne	KL				
I	primary structur of dsD value p DNA, of pro DNA semi-co method replicat non-rec Hollida transpo transpo mechan transpo for tran bacteri transdu abortiv recomb	tion. Recombination: reciprocal ciprocal, mechanisms of recombination and model. Transposons: Classes esable elements, nomenclature esable elements, Insertion sequentism of transposition. Effects estition in bacteria. Genetic requirements in transformation, conjugate transformation, conjugate esable elements, in transformation, conjugate esable elements, in transformation, conjugate esable elements esable elements, in transformation, conjugate esable elements element	DNA, chary model and C A, A ation as in an of circle of and ation, and of ments assessed in and of gene	types. Knowledg	ge of replication, ge on reco	ombi-	1,2,3, 4,5,6				

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

	Gel casting and gel loading	30	Proficiency in DNA	
l	2. Isolation of DNA (plasmid DNA,		isolation and separation,	
[ca]	Chromosomal DNA, Fungal DNA)		preparation of competent	
cti	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					

	SEMESTER – I										
Course	Title		Biochen	nistry							
Course	Code	740/150/1121	Credits:	4 45T+30P	<u>L</u>	T 0	P 2	S 0	R	O/F 0	C 4
Pre-req	uisite	Nil	Co-req		- 3	U	<u> </u>	Ni		U	1 4
Program				cience in M	 Iicrobio	logy					
Semeste				f First Yea				<u> </u>			
Schieste		1. To study the structure of bi							s car	hohvd	rates
Cour Objecti		and lipids 2. To know the functions at knowledge of the structure are associated with life? 3. To study the metabolic path	nd intera of cells a ways of b	actions of band the various	piomoleous func	cules tions arbol	, wh perf	nich v forme	vill p d by t	orovide hem v	e the which
СО	1	Improve the concept of chem macromolecules	ical inter	ractions and	d molec	ular	orga	nizatio	on of	micro	and
CO	2	Understand the composition, s	tructure a	and function	of the	biom	olec	ules			
СО	3	Enhance the understanding on	metaboli	ism and phy	siology	of ce	ell.				
CO		Analyse the concepts of secon									
СО		Prepare the base for underst functioning at molecular level.	tanding o					biolo	gy a	nd ce	llular
Unit No.		Content		Contact Hour	L	earn	ing	Outco	me		KL
I	Conc	cept of biomolecules (compo	osition,	10	Knowledge on the concept of					t of	1,2
	Prote	eture and functions): Carbohy ins, Lipids, Nucleic acids, Vi Minerals.			biomothe with to the	vario horo	ous ugh	bion under	olect stand	iles ing	
II	thern free phos phos catal enzy	energy), reaction kinetics: Suphorylation and ox phorylation, Enzymology: Prince ysis, enzyme and enzyme k	cs: Concept of mics (entropy, enthalpy and), reaction kinetics: Substrate tion and oxidative tion, Enzymology: Principle of nzyme and enzyme kinetics, ulation, mechanism of enzyme Importance of enzymes in				tics tics of its	1,2			
III		bolism of biomolecules:		10	Build	kn	owle	edge	of	the	1,2
Carbohydrate metabolism: Glycolysis and its regulation, Gluconeogenesis, Glycogenolysis TCA cycle, Pentose phosphate pathway, glyoxalate pathway. Lipid metabolism: oxidation of saturated and unsaturated fatty acid, odd chain fatty acid, regulation of fatty acid metabolism.			genesis, Pentose vay. turated in fatty ism.		bioche synthe the ca with i	emica esis a arbol ts reg	al and o nydra gulat	pathw degracate are	rays lation Id lip oncept	of of oids t	
Dea Nuc		no acid metabolism: Transam nination and its types, urea cycle eotide metabolism: biosynthes adation of purines and pyrimidin	e sis and	and nucleotide synthesis				iesis a	and its	1,2,3	
V	and S Hemo	e Metabolism and Photosy Secondary metabolites: e synthesis and degra osynthesis: Structure of chlor	dation,	7	Learn breake knowl mecha	the down ledge	of	on	ne, g	ain the	1,2,3,

	light reaction and dark reaction, Brief concept on the secondary metabolites (Flavonoids, terpenoids, phenolic acids and alkaloids)		and apply the concept of secondary 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 various fields	1,2, 3, 4

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 – I										
Course	Title			strumentat	ion						
Course	code	23MSMB114R	Total credits: 4	207	L	T	P	S	R	O/F	C
			Total hours: 45T+		3	0	2	0	0	0	4
Pre-rec	quisite	Nil	Co-requisi					N	1 l		
Progra	mme		Master of Sci	ence in Mi	crobi	olog	y				
Semest	er		Fall/ I semester of f	irst year of	the I	Prog	ram	me			
Co	ourse	•	edge about the work	•		Biom	edica	al Ins	trume	nts.	
	ectives		rinciple of different i								
			le of chromatography						.•		1
C	: 01	operation, analysis	ography techniques	including	nisto	ory,	cias	SITICE	ation,	princi	pies,
			ation techniques, o	classificatio	n n	rinci	nles	on	eratio	n and	its
C	CO2	application.	ation teeninques, v	orassiricatio	п, р	111101	pres,	, ор	Ciuno	ii uiio	165
	CO3	* *	stigate Electrophore	esis, its ca	itegor	izati	on,	unde	rlying	princ	iple,
	.03		s, pH meter function								
C	CO4		pe dating principles	s, including	dete	ection	n, m	easu	remen	t, isoto	ppes,
		radiation, units and		:	1.a.a	ا، بده		4: 1	a1:		1-:11 -
C	CO5		ehensive understand copic methods for sci			ana	prac	ucai	appno	cation s	KIIIS
Unit		Content	copie methods for ser	Contact	•	earr	ning	Outo	come	I	KL
No.		001100110		Hour				0 444			
I		tography: History		10	Able	2	to	d	lescrib	e,	1,2
		principles, operatio			illustrate and explain						
		(Paper, Column, A			chromatography and applications				nd the	their	
		Thin layer, Ion exc ange, and Gel Chrom			appı	1cati	ons				
II		gation: Types; App	<u> </u>	10	Able	خ.	to	d	lescrib	e 1	1,2
	rotors;	density gradient	_	10					lain t		.,_
	centrifug	ation.	·		cent			•			
III	Gel El	ectrophoresis: Ap	plication; Types;	8	Able to descri				-	1,2	
		; pH meter (Pri							lain t	ne	
	_	technique: South	ern, Western, &		elect	troph	ores	is			
IV	Northern Radio- is	sotope dating techn	iane: Introduction	7	Able	<u>د</u>	to	А	lescrib	e 1	1,2
14	nature,		measurement of	,					lain t		1,2
	,	vity, radioisotopes			radio						
	radioacti	*									
V Spectros				10	Able		to		lescrib		1,2
Principle		and application of s	pectroscopy					exp	lain t	ne	
Omanatic		n of molecules from	given cample by	30	spec			ise	vario	ne 1 ′	2,3,4
=		chromatography	given sample by	30					alysis		٠,٥,4
tica		n chromatography			111561	31110	1100 1	or un	J 515		
Practical		ayer chromatography									
Pı	4. Separa	ation of DNA and pr									
	gel electr	ophoresis									

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 – I									
Cou	rse Title		Fundamental of S	Statistics	5					
Cou	rse code	23UMFS111R						R	O/F 0	C 3
Pre-	-requisite	Nil	Co-requisite			<u> </u>	Nil			
Pro	grammes		Master of Science	ce in Bio	techi	nology				
Sem	ester	Fal	II/I Semester of Firs	t Year o	f the	Prograi	mme			
	Course ojectives	scientific research 2. Introduce student (mean, median, a deviation).	nd the role of statis s to descriptive statis nd mode) and measo ow to summarize and	stics, inc	ludin lispei	ng measursion (ra	res of c	entral iance	tende	ency dard
	CO1	Improve understandin	g of Descriptive Stat	istics and	d Der	mograph	y.			
	CO2	Develop knowledge t methods.		·					•	
	CO3	Develop knowledge t data analysis.	o understand the me	thods fo	r hyp	oothesis	testing a	and B	iologi	cal
	CO4	Develop knowledge to	o understand the prin	ciples of	vario	ous statis	stical an	alyses	of dat	ta.
	CO5	Develop knowledge o	n R language for dat							
Unit No.		Content		Contac Hour		Lear	ning Ou	tcom	e	KL
I	Statistics, sample. Da	Methods: Definition concepts of statistical ta: quantitative and quascales of measurement duration	alitative, attributes,	5	F ₀	oundation Inderstant of Statisti	nding	cepts		1,2
II	Presentation histogram Tendency: Dispersion deviation,	on: tabular and gra and ogives. Meas mathematical and posit	ures of Central tional. Measures of deviation, mean	5		roficienc resentati			Data sis	1,2
III	III Bivariate data: Definition, scatter diagram, simple, 5 Knowledge on Analysin						and	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.						of and	1,2			

V	Testing of hypothesis , parametric test: t-test, z-test, chi-square test. Non-Parametric test: One sample	7	Application of Hypothesis Testing and Statistical Tests	1,2
	Kolmogorov test, wilcoxon Signed test, Mann-Whitney Test, Kruskal walis test.			
Practical	 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 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. 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. 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. Parametric test and Non-Parametric test 	30	A brief knowledge on using R for data analysis and visualization	1,2, 3,4

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	Course Title MINI RESEARCH (REVIEW OF LITERATURE-R1)								
Course code	23MSMB115R Total Credits: 2		L	T	P	S	R	O/F	C
Course code	25WISWIDTISK	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	ology	7				
Semester	Fal	ll/I Semester of First Year of	the l	Progi	ramn	1e			
Course Objectives	2. To enhance students' ability to critically analyze existing literature and summarize 1								
CO1	Employ databases an effectively	d library resources to gather of	origin	al res	earch	, boo	ks, aı	nd artic	eles
CO2	Summarize and diffe and descriptive revie	rentiate between various type ws.	s of 1	reviev	vs, sp	ecific	cally	analyt	ical
CO3	Identify research top information.	ics and employ appropriate r	netho	ds fo	or col	lectin	g and	d filter	ing
CO4	Critically analyze the demonstrations and findings of previous authors to comprehend their contributions and insights.								
CO5	Compose a detailed chosen study.	review that explains the pro	spect	s and	l futu	re di	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	VE ENGL	ISH (Comm	unica	tive	Engl	ish &	Soft S	Skills)	
Cours	se code	23UMPD111R	Total Cre		L	T	P	S	R	O/F	C
Pre-re	equisite	Nil	Total Hou	equisite	0	0	4	0	0 Nil	0	2
	rammes	1111		r of Science	in Bio	otech	molo		. 111		
Semes		Fa		ter of First Y					me		
	Course ojectives	 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. 									
	CO1	Analyze and identify	the differen	nt types of se	ntenc	es.					
	CO2	Able to integrate the	skills of rea	ading and spe	aking	g in p	rofes	sional	comn	nunicatio	n.
	CO3	Illustrate code Etique	ette sessions	s will boost th	heir c	onfid	lence	and n	norals.		
	CO4	Describe about the ef	ffective and	efficient util	izatio	n of	time.				
	CO5	Explain the concep 'pronunciation	t of Phone	etics and its	s imp	orta	nce v	will i	mprov	e the le	earners
Unit No		Content		Learning Outcome						Contact Hour	KL
I	Assertiv	nge of Interrogative Sentences, Exclama e Sentences, Types of a Errors, Synonyms, A	tory and Tenses,	structure assertive	sente hance	nterro nces.	Tra gram	ve ar insfor matic	m al	10	1,2
II				Develop reading comprehen ability to textual systematics	nsion reca	with and	impro		er ne ze	15	1,2
III	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 listening skills.					of ce al	10	1,2
IV	Conflict Management: Definition, Type of Conflict Management, Effects of Conflict Management, Methods to deal with Conflicts (Negative)			Learn stra resolve co encourage environme into opport	onflict	ts ef a turn	fective I ing c	vely positiv onflic	to ve	10	1,2

V	Time-Management Skills	Enhance productivity and stress	15	1,2
·	Introduction To Time Management, Purpose And Importance of Time Management, 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.	management through effective time allocation and planning. It helps to understand the importance of time management in achieving personal and professional goals.	13	1,2

- 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																	
	urse Title		Total Credits:	Immunolog	gy I		P	S	R	O/F	C						
Co	urse Code	23MSMB121R	Total Hours: 4		3		2	0	0	0	4						
Pre	-requisite	Nil	Co-re	quisite		l .	1	Nil	1								
Pro	grammes		Master of	Science in M	Aicrobio !	ogy											
Ser	nester	Spi	ring/II Semester	of First Yea	ar of the	Progr	amme	9									
	Course bjectives	1	s understand the n, antibody, immu s learn various in	unity, Hyper	sensitivit	y, Auto	Dimmı	ınity		ie							
	CO1	Describe the immun mechanisms.	e system and its	s component	ts and th	eir mo	de of	actio	n in	defe	ıse						
CO2 Outline antigen and antibody structure, types, and promonoclonal and polyclonal antibody production																	
	CO3	Apply the knowledg interpretations aiding								iple, a	ınd						
	CO4	Interpret transplantat	ion and cancer in	nmunology f	findings a	nd the	ir role	in res	searc	ch.							
	CO5	Discuss immunolog prevention strategies			mmunity	and	hype	rsensi	itivit	y, th	neir						
Unit No.		Content		Contact Hours	Lea	Learning Outcome				KL							
I	history, s the immu- immune s and cel Immunity acquired i Antigens adjuvants, types, anti- opsonisation	- types of immunity mmunity, APC.	Overview of organs of the onse- Humoral ne response. y- Innate and ores, haptens, r - Structure, tor functions - d complement,	10	Knowledge of Immune system, Immunity, immune response Knowledge on antigens and their properties and antibodies and their types along with their			s d s r	1,2								
	Antibody productio immunoto antibodies genes- an Immunog	production and production and production and production and production of monoclonal production, abzymes, esc. Expression of intibody diversity, class lobulins	antibodies, extraction of nmunoglobulin s switching of		product purifica	tion pr		an									
III	applicatio Immunofl classical a	antibody interaction on a RIA, ELISA, We have a RIA, ELISA, ELISA	estern blotting, nent system – y, functions	10	Theoretical and practical knowledge on principle and process of different immunological diagnostic tests				knowledge on principle and process of different immunological diagnostic			knowledge on princip and process of different immunological diagnosti			e it	1,2	,
IV	typing, Mi immunolo suppressiv transplanta Immune functions, TNF, Int	heories of antibody for HC, T cell receptors, gy — Graft rejecte therapy, immune to ation effectors — Cytoki cell mediated cytotoxic erferons, Inflammatic and migration	Transplantation tion, immune lerance, clinical nes, IL and icity, NK cells,	8	Knowle tation immune	immu	nology	_		1,2	,						

V	Hypersensitivity and types, Autoimmunity,	10	Knowledge on Hyper-	1,2
	Cancer and immune system – tumor antigen,		sensitivity, Autoimmunity,	
	tumor evasion and immunotherapy of cancer,		cancer immunology,	
	AIDS – primary and secondary		immunodeficiency and	
	immunodeficiency. Vaccines and its types		vaccines	
	Precipitation Reaction:	30	Able to operate ELISA,	1,2,
	i. Double Diffusion Reaction		RIA	3,4
	ii. Single Diffusion Reaction			
cal	iii. Ouchterlony immunodiffusion			
cti	iv. Immunoelectrodiffusion			
Practical	Agglutination Reaction: (Qualitative and			
1	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:

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	rse Title	Molecul	ar Biology, Genon	nics An	d Genetic l	Engi	neer	ing	-		1
Cour	rse code	23MSMB122R	Total Credits: 4 Total Hours: 451	T+30P	L 3	T	P 2	S 0	R 0	O/F 0	C 4
Pre-i	requisite	Nil	Co-requ	isite		1 -		Ni	l		
Prog	rammes		Master of Scien	ce in N	Aicrobiolog	y					
Seme	ester	Sprin	g/II Semester of Fi	irst Ye	ar of the Pr	ogra	amm	ie			
Course Objective: 1. To teach in depth about genome and its arrangement in eukaryotes at transcription and its arrangement in eukaryotes at transcription and its arrangement in eukaryotes at transcription, transcription, transcription, transcription, transcription, transcription and its arrangement in eukaryotes at transcription and its arrangement in eukaryotes at transcription, transcriptio							ansla tea and	tion chin with	and p	oost ools	
	CO1	Explain the fundament proteins and the centre	al dogma.	•							
	CO2	Explain the methods different types of orgshotgun sequencing.									
	CO3	Compare prokaryotic chromosomal DNA a expression and regula	nd examine the vit								
	CO4	Illustrate the dynamic heterochromatin, ch acetylation, DNA mo regulation in both pro	nromosome painti difications, DNA n	ing, r nethyla	nucleosome	me	odifi	catio	ons,	hist	one
	CO5	Discuss the mutation crucial for maintainin							med	chanis	ms,
Unit No.	Content			СН	Learning	Outcome K			KL		
I	DNA struc	troduction to genomics, definitions of genome, NA structure and composition, RNA and the anscriptome, proteins and the proteome, the central ogma						1,2			
II	the basis to different ty	genomes, markers for genetic mapping, link ypes of organisms, pl nome sequencing, shots	age analysis with hysical mapping,	10	Sequencia detail fo mapping					in ge	1,2
III	Genomes of prokaryotes and eukaryotes, extra chromosomal DNA, role of DNA binding proteins in genome expression: methods for studying DNA binding proteins and their attachment sites, special features of DNA binding proteins, interaction between DNA and its binding proteins Knowledge on DNA replication in prokaryotes and eukaryotes with special emphasis on the proteins and enzymes involved .						and cial	1,2			
IV								ith nal	1,2		

\mathbf{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
tic	digestion of DNA and analysis of DNA fragments		biological samples followed	
Practical	by agarose electrophoresis.		by their in vitro	
Pr			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							
Course code	23MSMB123R	Total Credits: 3	L	T	P	S	R	O/F	C
		Total Hours: 30T+30P		0	2	0	0	0	3
Pre-requisite	Nil	Co-requisite				N	il		
Programmes		Master of Science in Microbio	ology	7					
Semester	Spring/	II Semester of First Year of the	e Pro	gra	mn	ıe			
	1. To search and retrieve biological information from different biological databases.								
Course	2. Knowledge on computational database management system and its application in								
Objectives	Biology								
	3. A basic idea on the structural biology using computer.								
CO1	A basic concept on Bio analysis	pinformatics and its significance	in th	e fi	eld (of b	iolo	gical d	lata
CO2	Knowledge on database	e management system and its app	licati	ion i	in B	iolo	gy		
CO3	A good knowledge on s	sequence submission tools as wel	l as t	oiolo	ogic	al se	earcl	n engir	nes
CO4	Knowledge on sequence	e alignment and analysis.							
CO5	Learn the concept of computer 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 alignment.	5	A good knowledge on sequence alignment and its application	1,2

V	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					

		•	SEMES	TER – II								
Cours	e Title	Mush	room C	Cultivation	ı: Techno-F	rofe	essio	nal				
Cours	e code	23MSMB124R		redits: 2 nours: 60		L 0	T 0	P 4	S 0	R 0	O/F 0	C 2
Pre-re	quisite	Nil		Co-requisite Nil								
Progra]			cience in Microbiology							
Semes	ter	Fall/ I	semeste	er of first	year of the	Pro	gran	nme	•			
Ob	ourse jectives CO1 CO2 CO3	2. To strengthen the p equipped laboratory a3. To know and exploreExplain different classes	 To strengthen the promotion of mushroom cultivation by establishing a well-equipped laboratory and offices. To know and explore the cultivation in Assam Explain different classes of mushrooms. Describe the reproduction and growth of mushrooms. 							vell-		
	CO4	Discuss the methods of co	_		room							
	CO5	Apply the techniques for				spen	t					
Unit		Content		Contact			ıg Oı	utco	me		K	KL
No.				Hour								
I	I Introduction: Background of mushroom (common feature, types and uses, edible mushroom, non- edible and poisonous mushroom common features on poisonous mushroom, uses of mushroom, important of mushroom, biological efficiency of mushroom) II Biology of mushroom (reproduction, growth and nutrition), Oyster and Button mushrooms, Mushroom structure designed and maintenance			characteristics, types, and uses of mushrooms, including the distinction between edible and poisonous varieties, and their biological efficiency. 12 Grasp the biology reproduction, and growth or						s e d d d d d d d d d d d d d d d d d d	2,3,4	
III	Laboratory techniques for production of mushroom spawn (seed) Methods for cultivation and harvesting of mushroom 12 Understand and apply the fundamental principles of mushroom spawn production 13 Understand and apply various techniques for mushroom cultivation.					of s 1,	f s 1, 2, 3					
V	Utilization of mushroom spent (waste). 12 Understand the environmental and economic benefits of utilizing spent mushroom substrate.							of	2, 3,			

- 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	se Title		Generic Elective	- Pub	olic I	Healt	h And I	Hygie	ene			
Cours	se code	23MSMB125R	Total credits: 2		L	T	P	S	R	O/F		C
Pro_re	equisite	Nil	Total hours: 30 Co-requisite		2	0	0	0 	<u> 0</u> Nil	0		2
		1411	-	Coiona	in	Mio	nahiala.		411			
	amme		Master of S				`					
Semes	ster	1 77 1 . 1	Fall/ I semester o				`			1.1		
	ourse	 To understand the concepts, significance and relevance of public health and hygiene. To understand the health hazards as associated with public health and hygiene. 										
Obje	ectives	,										
			3. To understand social health problems and health education in India. Explain the concepts of public health, evaluate India's health systems and policies, and									
C	CO1		pts of public health of nutrition, envir					•		•		
		-	nental health hazai						_			
C	O2		iene, waste manage			-		прас	is, allu	unuersta	anu	ше
C	203		ene concepts across					d. an	d indust	trial setti	ngs	
		, ,,	rstand the causes, p	•	-			-			_	
C	04		e and communicable									
C	05	•	Analyse social health issues in India and evaluate the role of health education and									
			oting dead diction a						O 1			
Unit No.		Content			ntac lour	t	Learning Outcome				ŀ	KL
I	INTRO	DUCTION			7		Knowle	dge	about	the	1	, 2
			alth Goals and				Concept		Goals,	and		, –
		ves of Public hea	• •				Objectiv			Public		
		health system in Inc	dia and in the rest				Healtha		_			
	of worl	а ГН ASPECTS					NRHU a	ina r	NUHM			
		ction to National	Health Policy -									
	Nation	al Rural Health Mis	sion (NRHM) and									
		al Urban Health I	· · · · · · · · · · · · · · · · · · ·									
		on and health, Envi										
II		on, air, water polluti CONMENT AN			5		Knowle	dge		on	1	2, 3
**	HAZA							_	al Pol		1,	- , 5
	Enviro	nmental degradatio				(degrada	tion,	Hygien			
		s, Impacts of wast					Food ad	ulter	ation			
		ls Environment &										
	Person	ment - Concept, Step al and mental	hygiene, Health									
		ring habits and ad	• •									
	Water	Purification Adult	eration of Food									
		rable Changes in										
		e- waste, Solid w	aste and Excreta									
III	disposa HYGII	ENE CONCEPTS			5		Knowle	dge	on h	ygiene	1	, 2
		Personal Hygiene Medical Hygiene Food			-			_	Medical,		1	., _
	Hygiene Industrial Hygiene						and indu					
IV	LIFE		ATED NON-		8				and pr		1,	2, 3
		MUNICABLE DISEA					knowled		ام ما	on		
L	Hypert	ension Coronary	Heart Diseases			(commur	iicab.	ie and	non-		

	Stroke, Diabetes Mellitus Obesity COMMUNICABLE DISEASES AND THEIR CONTROL MEASURES: Air Borne Disease: Tuberculosis, Influenza		communicable diseases	
	Food and water Borne Disease: Amoebiasis, Jaundice, Vector Borne Disease: Malaria, Dengue Contact Disease: Venereal disease and AIDS			
V	SOCIAL HEALTH PROBLEMS AND HEALTH EDUCATION IN INDIA: Smoking, Alcoholism, Drug Dependence and Their Dead diction. Eco-Friendly Environmental Practices, Effects of drug abuse, WHO programmes Government and voluntary Organizations – vaccination and awareness programme, First Aid	5	Knowledge on Indian Health Education and Social health problems	1, 2, 3

- 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	se Title	Rese	arch Method						_		-
Cours	se code	23UMRM121R	Total Cred Total Hour		$\begin{bmatrix} \mathbf{L} \\ 1 \end{bmatrix}$	_	P 0	S 4	R 0	0/F 0	C 2
Pre-re	equisite	Nil		requisite				N	Vil		
Progr	amme		Master of S	cience in	Microbio	logy					
Semes	ster	Spring	g/II semester	of First ye	ar of the	Prog	ram	me			
Course Objectives		 The course aims to enhance the students' a broad understanding of research methodology, including theory of science and qualitative and quantitative methods in research. 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. To develop Students competency in planning, conducting, evaluating and presenting a research project. 									
C	CO1	Students will have basic	knowledge o	f Research	methods						
CO2 Students will gain the knowledge				Research M	lethodolo	gy					
C	CO3	Students will be able to gain the Skill questionnaire development.									
C	CO4	Students will be able to	acquire the kr	owledge o	f basic R	eport/	disse	rtat	ion I	Proced	ure.
C	CO5	Knowledge on different	IPR rights								
Unit No		Content		Contact Hour	Lea	rning	g Ou	tcor	ne	ŀ	KL
I	meaning motivati significa research definition	,	research, ypes and a of good Problems-	2	Knowle ntal comethode the objective	ncepts ology, mear	of ining	rese nclu		n g	1,2
II	research differen Samplin Sample selecting design, Experim of Expe Way A	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			Able apply principl design, meaning research	inc g and	function fun	dam reso ng	enta earcl the	1 n e	1,2
Ш	tools of interval construct semantic statistica preparat develop	of data, sources of data data collection, Nominal and ratio — Attitution and measurement, rate differential (SD), Use all analysis, Schedules for ion and standment of survey instrument for the questionnaire	al, ordinal, ude scale ting scales, of scale in interviews lardization,	3	A goo differen identify and to collection	t type vari tools	s of	data	a and	d s	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

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	MINI	RESEARCH 2 (RESEARCH	[GA]	P A	NAI	YSIS	S)		
Course code	23MSMB126R	IR126R						O/F 0	C 3
Pre-requisite	Nil	Co-requisite				N	Vil		
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	lit	eratu	re an	d idei	ntify ar	eas
CO1	Analyze existing liter	rature							
CO2	Identify research gap								
CO3	Formulate research questions								
CO4	Formulate research objectives								
CO5	Prepare research sync	Prepare research synopsis							

	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							
Course Title	UNIVERSAL	HUMAN VALUES (UHV) +							,
Course Code	23UUHV101R	Total Credits: 2 Total Hours:15T+30P	1	T 0	P 2	S 0	R	0/F 0	C 2
Pre-Requisite	Nil	Co-requisite	1	U	4	Nil		U	
Programme	1,12	Master of Science in Micro	robiol	ogv					
Semester	Wir	iter/II semester of First year o			ramr	mo			
Schlester		ents appreciate the essential co					oon "		TC!
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 pla ethical human can mutually enriching	 and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings 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		of this course is explorational tic and rational study of the				-		•	
CO2	It is free from any de	ogma or value prescriptions.							
CO3	It is a process of self	f-investigation and self-explorat	ion, a	nd no	ot of g	givin	g ser	mons.	
CO4	facilitated to verify subsequent Experier		on th	eir N	Vatura	al A	ссер	tance a	and
CO5		exploration takes the form of a gin with, and then to continution.							
Unit No.		Content							
I	 Self-Exploration—V Experiential Valid Continuous Happin Right understanding fulfilment of aspira Understanding Hapscenario Method to fulfil that various levels. Understanding humaterial 'Body' 	 Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the 							
	 Understanding the Understanding the Understanding the appraisal of Physic	needs of Self ('I') and 'Body' - Body as an instrument of 'I' (I characteristics and activities of harmony of I with the Bod all needs, meaning of Prosperity e Sanyam and Swasthya-Practi- tice Sessions.	being 'I' an y: <i>Sa</i> ' in de	the d d har nyam etail	oer, s mony and	seer a y in ' Swa	I' asthy	a; cor	rect

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 nature-recyclability 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 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 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.

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	SEMESTER	k-II							
Cours	e Title	COMMUNICATION	N MASTER	Y (Communi	cative	Engl	lish &	Soft	Skills)		
Cours	e Code	23UMPD121R	Total Cre Total Hou		L T 0 0	_	S	R	0/F 0	C 2	
Pre-R	equisite	22UMPD111R Effective English	Co-re	quisite	1		N	lil	· ·		
Progra	amme	N	Master of Sc	ience in Micr	obiolo	gy					
Semes	ter	Spring/II	semester o	f First year of	f the P	rogra	amme	•			
	Course jectives	 To familiarize students use of prepositions. To enhance the writin writing. To convey meaning communication. Productivity and peachievement. 	ng skills in	different area	s incluing fo	ıding r, or	CV	and c	cover lo	etter	
	CO1	Explain prepositions, tag of	questions, an	d idioms corre	ectly.						
(CO2	Discuss and analyse differ	ent sentence	types and voi	ces.						
(CO3	Explain effective paragrap	ohs, precis, and professional documents.								
(CO4	Describe SWOT analysis,	goal setting, and personal hygiene principles.								
(CO5	Illustrate non-verbal comm	nunication a	nd body langu	age co	ncept	s.				
Unit No.		Content	Contact Hour	Lear	ning (Outco	me		K	L	
I	Tag quIdioms	Prepositions estions Phrases and Clauses complex, compound	8	Identify common errors and refine grammatical accuracy in communication.					,2		
II		and Passive Voice and Indirect Speech	6	Learn when voice effe- context and	ctively			each the	1,	,2	
III	ambiguParagraPrecis	sics of Writing; avoid hity and vagueness hiph Writing Writing Writing, Resume, CV and	6	Develop cleiminating expressions on preci	ambig which ise	guity	and vos to	ague	1,	,2	
IV	Self-ManaSWOTSelf-Re	agement Skills: Analysis egulation Goal Setting, al Hygiene	15	Learn to strengths, opportunitie personal improvemen	es, ar growtl	id tl	/eakn	rsonal esses, for self-	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.			
	Group Discussion (Theory):			
	• 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	ilizer pro	ductio	on)			
Cou	rse Code	23MSMB211R	Total Credits: Total Hours: 6		L 0	T P 4			0/F 0	<u>C</u>
Pre-	Requisite	General Microbiology, Biochemistry	Co-Requ	isite	NA NA					
Prog	gramme		Master of Scien	ce in Micro	biology					
Sem	ester	Fall/	3 rd Semester of 2	nd year of th	e Progra	mme				
	Course bjectives	2. Formulate, produ3. To provide ki	gronomic importa ace and apply Bio nowledge on t h as liquid cultu ons	fertilizers in he various	a pilot so method	ale ls of	bio	feı		
	CO1	Explain the Importance	of bio fertilizers	in plant deve	lopment.					
	CO2	Describe mass cultivati	on and inoculation	n.						
	CO3	Explain the importance	of Azolla as a bio	o fertilizers.						
	CO4	Describe the importance	e of phosphate in	bio fertilizer	s.					
	CO5	Apply the knowledge o	n the use of Fung		hiza.					
Unit No		Content		Contact Hour	Learning Outcome			me		KL
I	account of Cyanobacte	rs - Introduction, scop plant growth promoters a erial Biofertilizer: Algal of cyanobacterial bioferti	and regulators – ization – mass	10	Importa fertilize develop	ers ir	of n p	bio lant		1,2
II	identification method Mechanism	xing Bacteria: Isolation, con, mass cultivation a cof Rhizobium and of nitrogen fixation (- Biochemistry and molation.	nd inoculation Azospirillum. free-living and	15	Knowle mass c inocular	ultivat		bout and		1,2
III	cultivation	Structure and Morpho method and Application. importance of Azolla.	••	10	Importa	ance of	Azo	olla]	1,2
IV	inoculation Biochemistr mobilization	solubilizing Bacter tion, identification, mass method of F ry of Phosphate solu n. Carrier based inocul d Field application Refere	15	Importa phospha fertilize	ate i	in	of bio		1,2	
V	Mycorrhiza scope. A Arbuscular method of (AM), Lega	10	Importa Mycorr		Fung	gi,	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						

		SE	EMESTER	R-III							
Cours	se Title			Public Hea	lth And	Hyg	iene				
Cours	se Code	741/151/12/17/12	otal Credi				T		R	0/1	
		To	otal Hours			2	0 0		0	0	2
	equisite amme	Nil Ma		requisite ience in Mi	icrobiolo)OV		N	11		
Semes				first year o			nme				
С	ourse	1. To understand the concepts						ealth a	and h	nygie	ene.
	jectives	2. To understand the health ha	azards as a	ssociated w	ith publi	ic hea	alth a	nd hy	gien	e.	
	CO1	Explain the concepts of public assess the impact of nutrition	n, environ	ment, and n	nental he	ealth	on pu	ıblic	well-	-bein	g
(CO2	Analyse environmental healt importance of hygiene, waste		•		•	ets, a	ınd u	nder	stano	d the
(CO3	Describe key hygiene concept	ts across p	ersonal, me	dical, fo	od, a	nd in	dustri	al se	etting	s.
(CO4	Identify and understand the canon-communicable and communicable and commun		-	l control	mea	sures	of li	festy	le-re	lated
(CO5	Analyse social health issues					of he	alth (educ	ation	and
	1	programs in promoting dead d	diction and				- 0	4 -		1 .	TZ T
Unit No.		Content		Contact Hour	Lea	rnın	g Ou	tcom	e		KL
I	Concept of Public system in HEALTH Introduct National Nutrition sanitation ENVIRO Environm Sources, methods Assessme Personal habits Purificati Changes	of Public Health Goals and Ole health and Hygiene, Public India and in the rest of world HASPECTS ion to National Health Parall Health Mission (NRH Urban Health Mission (and health, Environmental and health, Environmental and Health Mission (India and health, Environmental and Health Mission (India and Health	Policy - IM) and (NUHM) health- lealth ZARDS: Pollution: reatment Relation plication, lestroying Water desirable	5	Knowle Conce Object Health NRHU Knowle Environ degrada Food ac	pts, rives and l J and edge nmen	Goa of Hygie INUF	Puene. IM Pollugiene	on tion,	1.	, 2, 3
III	Personal Hygiene	ENE CONCEPTS nal Hygiene Medical Hygiene Food ne Industrial Hygiene 5 Knowledge on hyg (personal, Medical, and industrial)									1, 2
IV	CABLE I Hyperten Diabetes DISEASI MEASU		Stroke ICABLE ONTROL	8	Theore knowle commu commu	dge inical	ole	and	on non-	Į.	, 2, 3

	Food and water Borne Disease : Amoebiasis, Jaundice Vector Borne Disease : Malaria, Dengue Contact Disease : Venereal disease and AIDS			
V	SOCIAL HEALTH PROBLEMS AND HEALTHEDUCATION IN INDIA: Smoking, Alcoholism, Drug Dependence and Their Dead diction. Eco-Friendly Environmental Practices, Effects of drug abuse, WHO programmes Government and voluntary Organizations – vaccination and awareness programme, First Aid	5	Knowledge on Indian Health Education and Social health problems	1, 2, 3

- 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-III													
Course	Title		Resear	Research Ethics									
Course	Code	23UMRE211R		Total Credits:1 Total Hours:15			P 0	S 0	R	O/F 0	C 1		
Pre-Rec	quisite	NA	Co-Requi		1	0	U	NA		U			
Prograi	_		Aaster of Science		biol	ogy							
Semeste	er	Fall/ 3	S rd Semester of 2	2 nd year of t	he j	pro	gram	l					
	ourse ectives	 and to emphasize the research practices. 2. To address issues reand the importance of falsification, and pla 3. To develop critical to 	 To address issues related to authorship, publication ethics, peer review, and the importance of avoiding research misconduct like data fabrication, falsification, and plagiarism. To develop critical thinking and ethical decision-making skills to navigate complex research scenarios, balancing scientific progress with respect for 										
(CO1	Describe and apply resear	ch ethics theorie	es and metho	ods.								
(CO2	Explain research ethics is	sues such as resp	ponsibility,	vett	ing,	and	misc	ond	uct.			
	CO3	Illustrate arguments and r	esults in ethical	research inc	luiri	ies.							
(CO4	Identify and apply proced	dentify and apply procedures for sampling, data collection, and reporting.										
C	CO5	Apply ethical principles to research design and evaluation											
Unit No.		Content	Contact	Lear	nin	g O	utcor	ne		K	Ĺ		
INO.	ETHICS		Hours 3	Understar	ad .	and	onn	lv, 12	OV.	1,	2		
	Introduction other; an Ethics: do nature of reactions. regulation candor, convership interest; Non-Hum researcher	ach ory. hy, and f — sty, that s of and	ethical principles and moral theories in research contexts, critically evaluate issues related to research ethics.										
П	Ethics w research. research i Scientific Fabrication Redundant overlapping slicing.	Intellectual honesty a ntegrity. misconducts: Falsification, and Plagiarism (FFP). at publications: duplicate and publications, sala	and	Understar ethical pr scientific demonstra honesty integrity, prevent miscondu	rinci ate a	iple: ind	co intel re gnize	ondu lectu sear	to ct, ial ch	1,	2		

III	PUBLICATION ETHICS-	3	Understand the importance	1,2
	Publication ethics: definition,		of publication ethics,	
	introduction and importance.		recognize best practices and	
	Best practices/ standards setting		standards	
	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.			
IV	OPEN ACCESS PUBLISHING	3	Understand the concept and	1,2
	Open access publications and		significance of open access	
	initiatives. SHERPA/RoME0 online		publishing	
	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			
	Journal Suggester, etc.			
V	PUBLICATION MISCONDUCT	4	Gain proficiency in	1,2
	Group Discussions; Subject specific		navigating indexing and	
	ethical issues, FFP, authorship. Conflicts of interest. Complaints and		citation databases	
	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.			
	armeures.			

- 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	MINI RESEARCH (SURVEY/EXPERIMENTS-R3)							
Course Code	23MSMB213R	Total Credits: 2	L	T	P	S	R	O/F	C
Course Coue	251VI5IVID213K	Total Hours: 120 (P+S)	0	0	6	4	0	0	4
Pre-requisite	Nil	Co-requisite				Nil	l		
Programmes		Master of Science in Biot	echno	ology					
Semester	Spri	ing/II Semester of First Year	of the	Prog	gram	me			
Course Objectives	formulation and s 2. To gain hands-or test hypotheses. 3. Develop skills to	orinciples of designing effects sampling techniques. In experience in designing and control of the present research findings of the posters and slide posters and slide	ondu	cting	resea	arch (expe	riment	s to
CO1	Formulate research	methodology							
CO2	Prepare research too	ol(s)							
CO3	Apply the knowledge of sampling methods in sample collection.								
CO4	Design experiment	Design experiment using scientific method							
CO5	Investigate the resear	arch Problem							

	CO PO Mapping						
S.N.	Course Outcome (CO) Mapped Prog 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					

Course	e Title		EMESTER-III CORPORATE C	OMPETEN	CY					
	Course Code 23UMPD211R Total Credits: 2 Total Hours: 60P L T P S			R	O/F 0	C 2				
Pre-Re	equisite	22UMPD121R	Co-Requisi		U	4	NA		U	<u> </u>
Progra	ammes	Communication Mastery N	laster of Science	in Microbio	logy					
Semes			Semester of 2 nd y			mme	!			
	ourse ectives	 To acquaint students w To acquire the speaki listeners. To increase proficient guidance for self- pron To prepare and train th 	ng skill instruct, acy, present abilitation and self-ev	influence, en ity and qua aluation in so	gage, lity o ocial n	educa f res	ate, sum	or a	d pro	
C	01	Able to speak with greater	control and charis	sma in front o	of othe	ers.				
C	203	Discuss the positive impac	t in their thought	process and p	orobler	m-sol	ving	g skil	ls.	
C	CO3	Illustrate with all the neces	ssary tools and sk	ill sets to pre	pare p	rofes	sion	al re	sume.	
C	CO4	Discuss the highlights and	assess themselves	s in social me	dia.					
C	205	Explain the impart in the develop strategies to crack confidence	•		•					
Unit No		Content	Contact Hour	Lea	rning	Outo	com	e		KL
I	• Essen preser	tion Skills: tial characteristics of a good ntation ration of a good presentation	4	Understand the importance of presentation skills in personal and professional contexts. It also helps to recognize key elements that make a presentation effective, such as clarity, engagement, and structure.					nd lso nts on	1,2
 Unders of Pub Confid Physio Proces Tips Speaki Tips Presen Proces Presen Delive 		of Public Speaking, erstanding and Overcoming ablic Speaking, Eidence and Control, iology and Stress - Co ess, for Presentations and laking, for Using Visual Aid entations, ess for Preparing and Cre entations, vering Presentations Successf bt Clearing and Summary of	ontrol/ Public Is in eating fully,	Learn psycl strategies t speaking ar	o man		•			1,2

III	Practical session on Resume, Curriculum Vitae, Writing cover letter & LinkedIn Profile: Preparation, submission & screening of Resume. Practical session on cover letter screening session 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.	10	Gain expertise in drafting impactful cover letters and learn to create tailored resumes that highlight relevant skills and achievements.	1,2
IV	Research Paper – Writing Skills: How to write a research paper Key point in Research Work Interview Skills & Dress code Ethics: 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	20	Understand the fundamental principles and importance of leadership in various contexts.	1,2
V	 Mock Interview: Practical Mock Interview, Feedback- Receiving Feedback, Giving Feedback, Advantages of Effective Feedback, How to deal with negative feedback. 	6	Identify critical aspects of conducting research, including hypothesis formation and data analysis.	1,2

- 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	4 Discuss the highlights and assess themselves in social media.				
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 tle PERSONAL FINANCIAL PLANNING									
Course Title PERSONA			NAL FINA	NCIAL PLAN	NIN	IG	1		ı		
Course	Code	731111612022	Total Cred		L 0	T 0	P 2	S 0	R 0	O/F 0	C 1
Pre- Rec	quisite	22UUFL201R Introduction to Financial Budgeting And Planning	Co-R	equisite	U	<u> </u>	4	Nil	<u> </u>	<u> </u>	1
Program	nmes	Maste	r of Science	e in Microbiol	ogy						
Semeste	r	Fall/ 3 rd Sem	ester of 2 nd	year of the P	rogr	amn	ne				
	urse ectives	 The course would offer an interpretation of money, borrowing, lending Assess the personal financial methods of goal achievement Formulate a budget, record current financial goals. 	ng, taxes an l planning p nt.	d their applicat process, the life	ion to	to fir le of	anci fina	al pl ncia	anr l pl	ing. ans, a	and
CO	D1	Explain the cash management a	and buying	plan for homes	or a	uton	nobil	es.			
CO)2	Discuss a diversified investment	nt portfolio	for different ob	ojecti	ives.					
CO	D3	Compare mutual funds, ETFs,	and real est	ate investment	optio	ons.					
CO	D4	Develop a financial plan for re	tirement and estate protection.								
CO	O5	Describe financial products and	d strategies	for long-term g	goals						
Unit No.		Content	Contact Hour	Learn	ing (Outc	ome	!		K	L
I	Planning Function Meaning control Time component and	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 bunding; Doubling period and	6	Students w comprehend t financial plan			ab umen		to of	2,	3
П	Meaning of Income, Direct & Indirect Taxes, Taxable Income, various heads of Income for tax Calculation, Non- taxable Income, Tax evasion and tax avoidance, GST, Tax Planning			Students w understand a aspects of inc				bas		1,	2
III	Strategies. Unit 3- Entrepreneurial planning — Meaning of Entrepreneurship, prerequisites for becoming an entrepreneur, Entrepreneurship Support Systems in India, Institutional support systems for entrepreneurs, Financial support systems for entrepreneurs; Venture Capital,			understand t	ereq	be conc uisite		sco	to pe of	1,	2

	Business Angels, Assistant of Government, Commercial Bank Loans and Overdraft.			
IV	Unit 4- Planning for investing in securities market — Investment avenues offered by Securities Markets, Primary Market 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.	6	Students will be able to analyse and interpret the different dimensions of stock market investment.	3,4
V	Unit 5- Planning for debts and Retirement Consumer credit - Introduction to consumer credit; choosing a source of 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.	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					
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	4 Develop a financial plan for retirement and estate protection. 9					
5	Describe financial products and strategies for long-term goals	5				

Course	SEMESTER-III THE TITLE Medical Microbiology										
	e Code	23MSMB214R	Total Credi	ts: 4	L	T	P	S	R	O/F	C
			Total Hours		2 3	0	2	0	0	0	4
	quisite	Nil		equisite				Nil			
Progra				of Science							
Semes	ter		all/ III semest		<u></u>				11	14	·: - 0
	urse ectives	 To familiarize to viruses, fungiore diseases. Explore the me virulence factors To teach difference factors 	and parasite chanisms by s, modes of t	es and pre which maransmission	evention icroorga on, and h	and nism ost-p	cont s cau athog	rol r se di gen ir	neasu sease	ires of e, inclu etions.	f the
C	01	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 generatreatment, and proph				hoger	nicity,	labo	ratory	y diagr	nosis,
C	04	Characterize fungi laboratory diagnosis	_	_		_	-	esis,	clinic	cal fear	tures,
C	05	Summarize different	types of para	sites, their l	life cycle	, path	ogene	sis ar	nd dia	gnosis.	
Unit No.		Content		Contact Hour			g Out			K	L
I	I Normal flora - Skin, mouth, upper respiratory tract, intestinal tract, urogenitaltract, eye. Transient flora. Infection process and Virulence factors of pathogenic bacteria –toxins, enzymes, capsular polysaccharides. Host pathogen interaction.				Unders of dif Learn to and v pathoge Explore interact Unders charact traits, bacteria Analyz	ferenthe in irulente enic et ions. tand eristic virule al pati	t bonfection host host the cs, binence hogen	dy s n pro actors bact -patho ge ocher factor s.	ocess of eria. ogen neral mical		,3,4
	Coryne Clostric Salmon Pseudor Spiroch	ococcus aureus, Strepto bacterium diphtheria, lium, Vibrio cholera ella spp, Shige monas, Mycobacteri aete, Mycoplasma, I diae, Listeria, Cam	Bacillus, , E. coli, lla spp, lum spp, Rickettsiae,		clinical diagnos treatme pathogs Apply disease manage	marsis, pent ens. the	rophy of know event	tions, laxis, bact ledge	lab and erial		

III	General properties, antigenicity,	10	Analyse and evaluate the	1,2,3,4,5
	pathogenicity, laboratory diagnosis,	10	general properties,	1,2,3,7,3
	treatment and prophylaxis of –		antigenicity, pathogenicity,	
	Adenoviruses, Herpes viruses, Pox		laboratory diagnosis,	
	viruses, Hepatitis viruses, Oncogenic viruses,		treatment, and prophylaxis of various viruses.	
	Polioviruses, Reoviruses, rotaviruses,		Examine emerging and re-	
	arboviruses (togavirus and flavivirus,		emerging viral diseases,	
	encephalitis, yellow fever,		including Ebola, SARS,	
	dengue). Influenza viruses, Mumps,		Corona, Chikungunya, and	
	Measles, Rubella, Rabies virus, HIV,		assess their impact on public	
	Emerging and remerging viral diseases-		health and control measures.	
	Ebola, SARS, Corona, Chikungunya.			
IV	Mycology, immunity, epidemiology,	10	Understand and Evaluate the	1,2,3,4,5
**	pathogenesis, clinical features,	10	mycology, immunity,	1,2,3,4,3
	laboratory diagnosis and treatment of:		epidemiology, pathogenesis,	
	Superficial cutaneous		clinical features, laboratory	
	Mycoses- Dermatophytoses, Tinea nigra,		diagnosis, and treatment of	
	Malassezia infection, Piedra		various mycoses.	
	Subcutaneous Mycoses - Mycetoma,		Understand fungal toxins, including aflatoxins—its	
	Sporotrichosis, lobomycosis. Systemic Mycoses - Histoplasmosis,		including aflatoxins—its definition, major types,	
	Blastomycosis, Coccidioidomycosis,		symptoms, and	
	paracoccidioidomycosis		pathogenesis.	
	Opportunistic Mycoses -Candidiasis,		pullogenesis	
	Cryptococcosis, Aspergillosis,			
	Zygomycosis			
	Fungal toxins - Aflatoxins- Definition,			
	major types of aflatoxins, symptoms and pathogenesis			
V	Protozoology - Introduction toprotozoa,	10	Gain knowledge on the	1,2,3,4,5
'	Amoebae – Entamoeba histolytica,	10	fundamental concepts of	1,2,5,4,5
	Flagellates-Giardialamblia, Leishmania		protozoology and	
	donovani.Sporozoa - Malarial parasites,		helminthology	
	Toxoplasma gondii, Blastocystishominis.			
	Helminthology - Cestodes ortapeworms-		Understand the	
	Taenia saginata, Tinea solium, Trematodes or flukes- Fasciola hepatica,		classification, biology, and medical significance of	
	Fasciolopsis buski.Nematodes- Ascaris		medical significance of various protozoa and	
	lumbricoides, Wuchereria bancrofti.		helminths.Top of Form	
	·		Bottom of Form	
	1. Study of different Biochemical tests –	30	Perform and interpret	1,2,3,4,5,6
	Indole, methyl red, voges proskeaur,		various biochemical tests,	
	citrate, Catalase, coagulase, oxidase,		Assess antibiotic sensitivity	
	Mannitol motility test, hydrogen sulphide production, urease test,		using the Kirby-Bauer method and broth dilution	
_	gelatin liquefaction test, fermentation		method.	
 tica	of carbohydrates, triple sugar iron		Apply and analyze different	
Practical	test, casein hydrolysis test.		staining techniques	
P ₁	2. Antibiotic sensitivity by Kirby-Bauer		Isolate and identify normal	
	method		flora from skin, nail	
	3. Antibiotic sensitivity by broth		scrapings, nose, throat, oral	
	dilution method		cavity, and ear samples.	
	4. Staining technique – Gram's, Acid fast, Capsular, Endospore, Flagellar,		Use lacto phenol cotton blue and KOH for fungal	
	rast, Capsular, Elluospore, Magellar,		and KOH IOI Tuligat	

	Metachromatic granular staining	mounting and identification
4	5. Isolation of normal flora from skin,	Perform Leishman and
	nail scrapings, nose, throat, oral cavity and ear	Giemsa staining
	6. Fungal mounting by lacto phenol cotton blue and KOH	
	7. Leishman staining, Giemsa	
	staining	

- T1. The Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill LivingstonCompany.
- 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	logy			
Course	e code	23MSMB215R	Total Credits:		L	T	P	S	R	O/F		C
			Total Hours:		3	0	2	0	0	0		4
-	quisite	Nil	Co-requ				•		Nil			
Programme Master of Science in Microbiology												
Semes	ter		Fall/ III semest									
Cou	ırse	 To understand the role of microorganisms as agents of environmental change. To recognize microorganisms as indicators of alteration of an ecosystem. 										
Objectives		3. To understand n	-						-			
C	01	Discuss various ec							_		eren	ice to
	01	ecological niches,	•	_			•		•			
		Asses the microbi										
CO)2	and microbial water		_	-							
C(22	Establish the role of	of microorganisi	ns in soil fe	ertility	with	refere	ence t	to bio	logical	nitr	rogen
CO)3	fixation through le	fixation through leguminous plants and genes involved in nitrogen fixation.									
CO	24	Describe microbia	l Bioremediatio	n and their	role i	in the	deg	radati	on of	envir	onm	nental
	<i>J</i> 4	pollutants.										
CO) 5	Illustrate microbial	l interactions and	d various bi	ogeocl	nemic	al cy	cles				
Unit		Contact										
		Content			I	Learn	ning (Outco	ome		K	L
No. I		bial Ecology: Intera		Contact Hour 15	Anal		nicro	bial (ecolog		K	
No.	abiotic	bial Ecology: Intera	ctors in an	Hour	Analy	yse r	nicro u	bial o	ecolog standir	ng		
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No.	abiotic ecosys factor, and su	bial Ecology: Interaction and biotic factoriem, ecological niconcept of communiconsion.	etors in an iche, limiting ity, fluctuation	Hour	Analy by intera and ecosy	yse raction bio	microl u as bet tic s,	bial of the second seco	ecolog standin abiot ors ologic	ng ic in al		
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II	Aquatic Microbiology: The aquatic environment — major environmental conditions influencing microflora. Distribution of microorganisms in the aquatic environments — freshwater environment, estuaries and marine environment. Microbiology of drinking water, water pollution, purification of water for human consumption. Assessment of microbial status in water and waste water. Wastewater characteristics, Effluent treatment processes (like trickling filter, activated sludge, oxidative pond, anaerobic digestion and chemical disinfection), Bacterial indicators — DO, BOD, COD, water purification	10	Understand the impact of major environmental conditions on microflora in aquatic environments. Explore the distribution of microorganisms in freshwater, estuaries, and marine environments. Study the microbiology of drinking water, including water pollution and purification methods for human consumption. Assess the microbial status in water and wastewater. Understand wastewater treatment process. Evaluate bacterial indicators such as Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) in water purification.	1,2,3,4,5
III	Soil Microbiology: Soil microbes and soil fertility, Nitrogen fixation: Biochemistry of Nitrogen fixation - mechanism of nitrogenase -hydrogenase - Assay of nitrogen fixation -physiology of legume root nodule, leghemoglobin - Synthesis, Genes involved in nitrogen fixation	7	Understand the role of soil microbes in soil fertility and nitrogen fixation. Learn the biochemistry and mechanisms of nitrogenise and hydrogenase, assay methods for nitrogen fixation, and the physiology and genetics of legume root nodules and leghaemoglobin.	1,2,3,4,5
IV	Bioremediation – Factors affecting the bioremediation process, Bioremediation of toxic waste sites; Bioremediation practices and technologies; Bioleaching of copper, gold uranium Role of microbes; Microbial degradation of environmental pollutants- industrial solvents, pesticides, petroleum hydrocarbons, xenobiotic; Bio deterioration – paper, textile, wood, metal, Corrosion – methods of protection Bio magnification	8	Understand bioremediation. Study the bioremediation of toxic waste sites and the role of microbes in bioleaching copper, gold, and uranium. Learn about microbial degradation of environmental pollutants. Explore bio deterioration of materials like paper, textile, wood, and metal, methods for corrosion protection, and the concept of bio magnification.	1,2,3,4,5
V	Microbial interaction: Competition, ammensalism, parasitism, mutualism, commensalism, synergism, Biogeochemical cycles – Carbon, Nitrogen, Phosphorus, Sulphur.	5	Understand microbial interactions. Explore the roles of microbes in biogeochemical cycles of carbon, nitrogen, phosphorus, and sulphur.	1,2,3,4,5

	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	
न्न	alkalinity		preparing biofilms.	
Practica	5. Determination of DO		Conduct bacteriological	
rac	6. Determination of BOD		examination of water.	
Ь	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			Agricultur				1	ı	1		
Cours	se Code	23MSMB216R	Total Credits Total Hours:		1 L 3	T 0	P 2	S 0	R 0	O/F 0	<u>C</u>	
Pro_re	equisite	Nil	Co-requ		3	U	_	Nil	U	U	4	
	ramme	1411		of Science	in Micro	hiolo	σv	1111				
Semes			Fall/ III semest					mme				
Bellie	5001								rofile			
	ourse ectives	 To familiarize the students about the different types of soil and soil profile. To teach about the different types of microorganisms found in soil and their application in improvement of soil fertility. Understand microbial involvement in biogeochemical cycles, such as the nitrogen, carbon, phosphorus, and sulfur cycles, and their importance in soil fertility. 										
C	CO1	Describe soil prof	•	nics of po	sitive an	d ne	egativ	e inte	eracti	ons be	tween	
		microbes and plants										
C	O2	Explain the nitroge						_				
C	03	Discuss the princip modification.	**				•			•		
C	O4	Analyze host-paras in plants.	ite interactions,	and the rol	e of R ar	nd r g	genes	in dis	sease	develo	pment	
C	O5	Identify post-harve	st diseases to im	plement eff	ective co	ntrol	meas	sures.				
Unit No.		Content		Contact Hour	Le	earni	ng O	utcon	ne		KL	
I	found in Microbe interacti Negativ sideropl Nitroge symbiot enzyme	ion and types, re interaction and re hores n cycle, Symbiotic tic Nitrogen Fixatio and nif genes	and Non n, Nitrogenase	7	7 Understand the soil profile and identify the types of microorganisms found in soil and plant surfaces. Explore microbe-plant interactions. Study the role of siderophores in these interactions.							
III	microbe Azospin Bradyrh with leg Free Anabae Associa Anabae Bioferti (Bacteri based control based control based control based co	rillum), Rhizobium, anizobiumin symbioticumin symbioticumin symbioticuminous plants. Iliving cyanobacteria (ma azollae, lizer) Biopesticides far Bacillus thuring commercial products a, Trichoderma, viruses for insect pesur polyhedrosis mation—Ti plasmince, Agrobacterium	15	Underst function Learn a Explore techniq importa Agroba transfer	ns of bout pla ues, ince continues.	bio f bio p nt tr focu of Ti	esticion ansforsing plasn	ers des matic on tl nid ar	on ne nd	2,3,4,5		

IV	Host parasite interaction, production of phytoalexins, involvement of elicitors, role of R and r genes in disease development, Plant disease –bacterial – blight of rice, citrus canker, viral –TMV, Banana bunchy top, fungal–wilt, downy mildew, powdery mildew, smut and rusts, mycoplasmal – sandal spike, grassy shoot of sugarcane	8	Understand host-parasite interactions, including the production of phytoalexins and the involvement of elicitors. Explore the role of R (resistance) and r (susceptibility) genes in disease development. Study plant diseases caused by various pathogens	1,2,3,4
V	Postharvest disease and control measures	8	Identify post-harvest diseases and their control measures, focusing on strategies to prevent and manage diseases affecting harvested crops and produce.	1,2,3,4
Practical	 Isolation of nitrogen fixing bacteria from legume root nodules Study of Rhizosphere and Phyllosphere Isolation of Phosphorus solubilizing microorganisms Observation of Anabaena from Azolla plants Microscopic observations of root colonization by VAM fungi 	30	Isolate nitrogen-fixing bacteria from legume root nodules. Isolate phosphorus-solubilizing microorganisms. Study the rhizosphere and phyllo sphere environments. Observe Anabaena from Azolla plants. Observe root colonization by VAM (Vesicular-Arbuscular Mycorrhizal) fungi.	1,2,3, 4,5,6

- 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, V^{th} 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				Clinical an	d Diagnostic Micro	biol	ogy	,				
Course	e Code	23M	SMB21	7R	Total Credi		L	T	P	S	R	O/F	C
	quisite		Nil		Total Hours	3	0	2	0	0 Nil	0	4	
Progra			1111			-requisite Science in Microbi	iolo	GV/			1111		
Semest				Fall/					amı	me.			
Scilles		1 To te	Fall/ III semester of first year of the Programme 1. To teach the importance of a microbiologist in diagnosis of microbial diseases.										
	urse	 To make students proficient in isolation and characterization of infectious organisms. 											
Obje	ctives	3. To an	3. To analyse the nature of the agent, Study the sensitivity pattern to drugs.										
C	01	Apply the from clin			lling clinical	specimens, isolating	g an	d ic	lent	ifyiı	ng mi	croorga	anisms
CO	D2	Perform microbio		nt immu	ınological te	echniques using im-	mur	odi	agn	osti	c too	ls in c	linical
CO	03	Describe	the cor	ncept of	vaccine and i	ts effectiveness and	safe	ety c	onc	ern			
CO	04	Apply th	ne advan	ced diag	nostic tools	and techniques for di	isea	se d	iagı	osi	S		
CO	05	Illustrate pattern.	e the co	oncept o	of antimicrob	pial chemotherapy,	mo	de (of a	actio	on, ar	nd sens	sitivity
Unit No.		Cor	ntent		Contact Hour	Learnin	ıg C	utc	om	e			KL
I	No. Introduction to clinical Microbiology: Role of Microbiologist in Diagnostic laboratory, General concepts for specimen collection, handling, transportation, processing, specimen work up, Laboratory safety and infection control. Scientific and Laboratory basis for Clinical/ Diagnostic Microbiology: Microscopic examination of infectious diseases, Growth and biochemical characteristics, Rapid methods of identification					Understand the role of a microbiologist in a diagnostic laboratory and key concepts related to specimen collection, handling transportation, processing, and work-up Learn about laboratory safety and infection control. Gain insights into the scientific and laboratory basis of clinical microbiology, including microscopic examination of infectious diseases, growth and biochemical characteristics, and rapid methods of identification.							
II	Immunotechniques and Immunodiagnosis: Antigens and Antibody reactions in vitro; Agglutination, complement fixation, ELISA, Western Blotting Immunodiffusion, Immuno-electrophoresis, Immunofluorescence, Immunoprecipitation, Radioimmuno-assay, and serotyping.				s; t n								2, 3, 4

III	Vaccines and Vaccination:	8	Understand vaccines and vaccination by	1, 2, 3,
	Vaccines and vaccination. Vaccines — definition, types, Antigens used as Vaccines, effectiveness of vaccines,	O	exploring types, antigens used, effectiveness, safety, current vaccines, adjuvants, and the differences between	4, 5
	Vaccine safety, current vaccines, adjuvants, active immunization and passive immunization.		active and passive immunization. Top of Form, Bottom of Form	
IV	Recent Diagnostic tools and	10	Understand recent diagnostic tools and	1, 2, 3,
	techniques: Principle, working and application of a) Autoanalyser b) Biosensor glucometer/ labon chip/microfluidics c) Diagnositic kits- ELISA, Western Blot d)Enzymes in Disease diagnosis and therapy: Lactate dehydrogenase, Aspartate aminotransferase, Alkaline phosphatase, Creatine kinase, Acid phosphotase, Cholinesterase		techniques, including auto analysers, biosensors (glucometers, lab-on-a-chip, microfluidics), diagnostic kits (ELISA, Western Blot), and the role of enzymes (lactate dehydrogenase, aspartate aminotransferase, alkaline phosphatase, creatine kinase, acid phosphatase, cholinesterase) in disease diagnosis and therapy.	4, 5
V	Antimicrobial Chemotherapy: Development of chemotherapy; General characteristics of drugs and their testing; Mechanism of action. Antibacterial drugs; antifungal drugs, antiviral and antiprotozoan drugs; antibiotic sensitivity testing, MIC, Drug resistance; mechanism of drug resistance; multi drug resistance.	10	Understand antimicrobial chemotherapy by exploring their mechanisms of action, and the specifics of antibacterial, antifungal, antiviral, and antiprotozoan drugs, including antibiotic sensitivity testing, MIC, and mechanisms of drug resistance, including multi-drug resistance.	1,2,3,4,5
Practical	1. Study of sample collection procedure, Storage protocol, Processing. 2. Isolation of pathogen from clinical sample and its antiprogram 3. Serological test, 4. Handling and working of rapid diagnostic kits. 5. Study of nature of antibiotics actions. Detection and analysis of antibiotic resistance	30	Learn sample collection, storage, and processing procedures. Isolate pathogens from clinical samples and perform antibiograms, conduct serological tests. Handle rapid diagnostic kits. Study the nature of antibiotic actions, and analyze antibiotic resistance.	1,2,3, 4,5,6

- 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 McGraw-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			Organic	Farmin	g						
Cours	e code	23MSMB218R	Total Cred Total Hour		80P	1 3	T 0	P 2	S 0	R 0	O/F 0	C 4
Pre-re	quisite	Nil	Co-	requisite					Ni	il		
Progra	amme		Master	of Scienc	e in Mic	robio	ology	7				
Semes	ter	Fal	ll/ III semest	ter of firs	t year of	f the	Prog	gram	me			
	ourse ectives	 Introduction to Concept of Organic cultivation. To discuss the Organic Farming System (OFS), its importance and benefits. To discuss the methods associated with organic farming – mulching, crop rotation tillage, bio-fertilizer etc. 										
C	:O1	Explain organic Farmi	ng, its princi	ples, scop	e and be	nefits	s for t	the h	ealth	and so	ociety	<i>y</i> .
	O2	Illustrate the relation cycles, soil preparation Discuss crop protection	and choice	of crop va	rieties, p	olanti	ng m	ateri	al and	d seed	treati	ment.
C	O3	effectiveness, preparin	~	•			_					
	O4	Explain the organic pro				ric, ba	anana	and	vege	tables	S.	
Unit	O5	Describe the concept of	t soil less fai									
No.		Content		Contact Hour		Lea	rning	g Ou	tcom	e		KL
I	Introduction Develop Principl Biodyna of Or Farming Farming OF Systems of Or Systems o		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,									
III	Pesticid Manage	Cultural and Mechanical method of crop protection, Biopesticides and Botanical Pesticides, Bio- control agents, Weed Management Management Organic crop production of Rice, Zinzer, Mechanical and bio fertilizers. Understand and apply crop protection methods, including cultural and mechanical approaches, bio pesticides, botanical pesticides, bio-control agents, and weed management techniques.								1, 2, 3, 4, 5		
V	Concep	s – Hydroponics, A	ic farming	6	practices for rice, ginger, turmeric, banana, and vegetables. Explore modern organic farming methods, including hydroponics, aquaponics, and vertical farming.							

- 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						SEMESTER – IV										
Course Title	MINI RE	SEARCH - IV (RESEARCH DA DOCUMENTATION-		AN	ALY	SIS A	AND											
Course Code	23MSMB221R	Total Credits: 12 Total Hours: 360 (P+S+R)	L T P S R O/I 0 0 20 4 6 0				0/F 0	C 12										
Pre-requisite	Nil	Co-requisite	Nil															
Programmes		Master of Science in Biotechnology																
Semester	Spr	Spring/II Semester of First Year of the Programme																
Course Objectives	2. To be able to anal	s to apply experimental methods tyse research data pile and document research data.	o sol	lve a	give	n scie	entific	e task.										
CO1	Learn to tabulate rese	earch data																
CO2	Analyze research out	tcomes																
CO3	Correlate with exitin	g literature																
CO4	Prepare an effective	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	Indu	strial M	icrobiolog	y and Ferme	ntatio	on							
Cours	se Code	73MSMR777R	otal Cre		L	T	P	S	R	O/F				
				urs: 33T+.		0	2	0	0	0	3			
	equisite ramme	Nil		Co-requisite	e n Microbiolo			Nil	<u> </u>					
Semes							ram	me						
bellie	<u> </u>	Spring/IV Semester of second year of the Programme 1. To familiarize the students with the concept of fermentation processes & the use of												
		different microorganism			r		F							
	ourse	2. Understand the principles, types, and design of fermentation processes, including												
Obj	ectives	submerged and solid-state fermentation.												
		3. To teach the students about the different industrial products produced by												
		microorganisms.												
(C O 1	Explain the principles of di	verse bio	oreactors ar	nd their advan	tages								
		Illustrate different microbia						velor	men	t of no	ovel			
	CO2	applications.		•	J			1						
	702	Illustrate various fermentat	tion prod	ducts and t	he underlying	g biot	techn	olog	ical ₁	princi	ples			
	CO3	involved.												
C	CO4	Describe various downstrea	ım proce	sses and th	eir storage an	d pac	kagi	ng te	chnic	ques.				
	CO5	Explore the potential of usi	ng micro	bes to prod	duce metaboli	tes in	indu	ıstria	l sett	ings.				
Unit		Content		Contact	Lear	ning	Outo	come	!		KL			
No.				Hour										
I		Principles of Fermentation		8	Understand various types of									
	bioreacto	ors: Bioreactor types, immors, types of fermen	nobized ntation.		bioreactors applications		and		the	eir 3	3, 4, 5			
		ation kinetics and Monods M					.1 1		•	,	3			
		kinetics and Monod's			Comprehend the principle									
	Substrate	· · · · · · · · · · · · · · · · · · ·	specific											
		rate, stringent response, N			Identify key									
		tem, growth limiting sunne energy, growth yie			the optimization processes.	ation	OI I	erme	ntatio	on				
		formation.	id and		processes.									
	Process	optimization: factors												
		ion, rheology of fermentatio												
TT	oxygenat	ion, and oxygen transfer kind	etics.	6	Loom tools	iana	o fo	r co-	·ooni:	n G 1	1 2			
II		al strain improvement Iso and improvement of mi		υ	Learn techi and isolati						1, 2, 3, 4,			
		altures: Screening and isolation of micro-			from variou						5			
	organism	organisms, primary and secondary			y Understand the production and									
		tes, enrichment, specific scr			importance	of	pri	mary		nd				
		esired product. Strain improvelected organism:	vement		secondary n	netabo	olites	S.						
	101 the S	ciccica organism.			Learn tech									
					microbial s yield and o									
					products.	5111C16	ысу	OI (uesir	cu				

III	IndustrialFermentationProductsBiofuels:-Ethanol,Hydrogen,MethaneAntibiotics:-β-lactumantibiotics (SyntheticPenicillin),Streptomycin, Cephalosporin.Biopreservative:Lactobacillussakei.Biopolymers:-Xanthan,Polyhydroxyalkanoates.Thermostableenzymes:-Proteases.Biosurfactants:acomparative account.	8	Understand the process of fermentative production of biofuels, antibiotics, bio preservatives, biopolymer, enzymes, bio surfactants from microbial sources.	1, 2, 3, 4, 5
IV	Downstream Processing and scaleup: Downstream processes: types of processing units and systems, Storage and packaging methods. Scale up: criteria involved in scale up, Productivity, power requirements, Basic control theory	4	Understand different types of processing units and systems used in downstream processing. Analyse factors affecting productivity and power requirements during scale-up.	1, 2, 3, 4, 5
V	Food and Healthcare products: SCP, various types and processes, SCO Aminoacids:-Lysine, Glutamicacid. Vitamins:-riboflavin, Vit.B12. Fatty acids (Palmetate, oleate). Organic acids Production of Fuels: Ethanol, Methanol Mushroom Cultivation and Wine production	7	Understand the various types of SCP and SCO, and the processes involved in their production. Gain knowledge on the biosynthesis and industrial production of vitamins, amino acids, organic acids, wine, fatty acids, and biofuels. Understand the techniques and processes involved in mushroom cultivation.	1, 2, 3, 4, 5
Practical	 Yoghurt production Yeast Fermentation Wine preparation Vinegar production Single cell Protein and Single Cell Oil Citric acid estimation Lactic acid estimation 	30	Perform fermentative produ-ction of yoghurt, wine, vinegar, SCO, SCP Estimate Citric acid and lactic acid produces through fermentation	1, 2, 3, 4, 5

- 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

SEMESTER-IV													
Cours	e Title				Microbiolog	gy							
Cours	e Code	23MSMB223R	Total Cred			L	T	P	S	R	O/F	C	
			Total Hou			2	0	2	0	0	0	3	
	equisite	Nil		Co-requisit					Ni	1			
Progra					in Microbiol								
Semes	ster				d year of the								
		1. The course provides contents of the food			•	_				met	thods	and	
Co	urse	2. The course provides	an integrate	d overview	of the field	of f	ood	micr	obio	logy	cover	ing	
Obje	ectives	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 microorga	nisms in plar	nt- and anin	nal-based foc	od.							
C	CO1	Describe the significant	ce of microo	rganisms in	n food and the	eir r	elati	on to	spo	ilage	2		
C	CO2	Apply the principles an	d techniques	employed	in the preser	vati	on o	f foo	ds.				
C	CO3	Analyze the role of mic prebiotics	robes in foo	d productio	on, and explo	re th	ne co	ncep	ot of	prob	oiotics	and	
C	CO4	Characterize different f	ood-borne il	lnesses and	associated n	nicro	oorg	anisı	ns.				
	CO5	Demonstrate safety mea	asures and co	ontrol progr	rams in food	pro	ducti	ion					
Unit		Content		Contact	Lea	rniı	ng O	utco	me		I	KL	
No. I	Food	& Microorganisms-	food as a	Hour 7	Understand	l the	rol	e of	foo	d as	a 1	, 2,	
		e for microorganisms,		,				nicro				$\frac{1}{1}$, 4,	
	microoi	ganisms in food mid	nicrobiology, identify key microorganisms i							5			
	general			food mici		_	•			he			
	spoilage Food		tamination,	principles of food spoilage, and gain knowledge on contamination									
			of cereal		preservation, and spoilag								
	•	ss/ vegetables & fruits/ m			prevention				•		_		
	_	s/ milk & milk produc	cts/ canned		food products								
TT	product				Annly the		rinoi	nlag	of	for	od 1	2	
II	_	oles of Food Preservation removal, anaerobic	condition,	5	Apply the preservation	•		•				, 2, , 4,	
	_	ation by high temperat	•		removal of							5	
	tempera	nture/ drying/ food	additives/		of anaero			nditi	,		nd		
	radiatio	n			methods su								
					low tempe food additive						of		
III	Foods	& Enzymes Produced b)V	8	Understand						ss 1	, 2,	
	Microo	rganisms- productions	of cultures,	-	of food fermentation learn about 3, 4								
		rmentation, foods & enz	ymes from		probiotics and prebiotics, their								
		ganisms			functions,								
		tics & Prebiotics- functi filus milks, yogurt, bu			in product milk, yogu								
	solid fo		accor minne,		formulas.	ι, υ	J. (C)		., uii	. 501			
IV	Foods	in Relation to Disease	e- bacterial	5	Correlate f	ood	bor	ne d	iseas	se aı	nd 1	, 2,	
		orne illnesses, non- bac										, 4,	
		ng/infections/ intoxicat isease outbreaks	ion, food		contributing	g to	1000	ı poi	sonii	ng		5	
<u></u>	borne a	isease outdieaks											

V	Food Sanitation, Control & Inspection- sterilization, microbiology in food sanitation, enforcement & control agencies- national/ international/ federal/ state/ private, Microbiological criteria for food	7	Understand the principles of food sanitation, including sterilization and the role of microbiology, and become familiar with the enforcement and control agencies at national, international, federal, state, and private levels, as well as the microbiological criteria for	1, 2, 3, 4, 5
			food safety.	
Practical	 MBRT of milk samples and their standard plate count. Isolation of food-borne bacteria and fungi from food products. Most Probable Number Analysis Microbiological examination of canned foods Isolation of spoilage bacteria from fruits and vegetables. Adulterant test – formalin and starch test Effect of temperature on the spoilage of food products. Production of fermented food and their microbial examination 	30	Assess milk quality, isolate food borne microorganisms. Estimate MPN Perform microbial examination of food. Perform adulterant test Able to produce fermented food	1, 2, 3, 4, 5

- 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				al Microbiol								
Cours	se Code	73MSMR774R		Credits: 3 Iours: 32	T+30P	-		P 2	S 0	R 0	0/F 0	C 3	
Pre-re	equisite	Nil		Co-requ		I			N	il	-		
)	ramme				e in Microbi								
Seme	ster				ond year of t								
	ourse jectives	 To teach the basic definition of pharmacology and kinetics of drugs in human. To understand the mechanism of action of antibiotics and the mode of spoilage of pharmaceutical products To incorporate in depth knowledge of techniques, processes and strategies in order to avoid any potentially costly and life-threatening failures and consequences. 											
(CO1	Explain pharmacology and	pharma	acokinetic	S.								
(CO2	Describe the mode of action antibiotics.	ion of a	antimicrol	bial agents, p	oathog	geni	city	, an	d re	sistanc	e to	
(CO3	Explore microbial pharmaceutical products, and their spoilage.											
(CO4	Execute Good manufacturing		_	•		_	-					
(CO5	Apply different physical arpharmaceutical industry.	nd cher	mical ster	ilization tech	nique	es to	en	sure	ster	ility in	the	
Unit No.		Content	(Contact Hour	Lear	ning	Out	con	ne		K	L	
-	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	Gain understandi including terminology pharmacody therapeutic, effects), (absorption, metabolism excretion), administrati methods	defini /, /nami a ph , rou	f pha ition cla ics dver harm	armassi assi rse, naco distr into	acolo sour ficat (acti to kine ribut eract	ces, tion, ons, oxic etics tion, tion, drug	1,2,3	,,,,,	
П	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 action of an Comprehen to antibiotic	tibiot d bac s and	tic. eteria	al re	esista ones	ance			
Ш	pharmac contamin pharmac injectable preparati sterilizati and	1 0	obial of terile llmic their lures of	7	Understand contaminati pharmaceut Learn manu and in-pr pharmaceut Gain pharmaceut microbial fe	on a ical p ifactu ocess icals; know icals	orodu iring s c wleda pro	sporucts g procont ge odu	ilage oced rol		1,2,3	3,4,5	

	produced by microbial fermentations (streptokinase, streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.		Explore new vaccine technologies Understand the process of vaccine clinical trials.	
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	 Antimicrobial assay of antibiotics - determine MIC Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations). Determination of antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardized experimental conditions. Determination of D value, Z value for heat sterilization in pharmaceuticals. Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations). 	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

				ESTER-IV											
Cours	se Title			arine Micro	obiology	I -			l a		0.75				
Cours	se Code	23MSMB225R	Total Cr Total Ho	edits: 3 ours: 32T+	30P	<u>L</u>	T 0	P 2	S 0	R 0	0/F 0	C 3			
Pre-re	equisite	Nil	1 3 3 3 3 3 3	Co-requisi		_	Ū		Ni		, ,				
Progr	amme		Master	of Science	in Microbi	olog	y								
Semes	ster	Spring	g/IV Seme	ster of seco	nd year of t	he I	Prog	gram	me						
	ourse ectives	2. To understand the ro	 To develop the knowledge about the biology of marine microbes and their distribution. To understand the role of marine microorganisms. To explore potential of marine microorganisms. 												
(CO1	Describe the distribution	on and sign	and significance of marine cyanobacteria and actinomycetes.											
C	CO2	Explain the marine eukaryotic microbial cell structure and functions.													
C	CO3	Discuss the role of mar	ine microo	rganisms ir	ocean acidi	fica	tion	and	sedin	nenta	tion.				
C	CO4	Characterize marine vi	Characterize marine viruses and virus-like particles.												
C	CO5	Explore the role of a compounds	marine mi	croorganisr	ns in the p	rodı	ıctio	on o	f var	ious	bioac	tive			
Unit No.		Content		Contact Hour	Lear	nin	g O	utco	me		Kl	L			
I	Occurrence and distribution, structure and biology, ecological role and significance of marine cyanobacteria, marine actinomycetes			5	Understand the occurrence, distribution, structure, biology, ecological role, and significance of marine cyanobacteria and marine actinomycetes						1, 2	, 3			
II	Introduc Overviev Function Dinoflag	eukaryotic microbes: tion to the protists and fu w of eukaryotic cell stru n Nanoplanktonic fl gellates, Bioluminescence al clocks Ciliates, Diator	cture and agellates, e and	7	Gain an in eukaryotic Understand structure ar Explore flagellates, biolumines clocks, cilis	mic d nd fo	robe euk unct n d ce,	es aryot ion; anop inofl	tic lankto agella piolog	cell onic ates,	1, 2, 4				
Ш	acidification, Marine microbes as a major component of the Plankton, Microbes play a key role in the formation of sediments microorganisms in ocean acidification, Recognize marine microbes as a major component of plankton, Explore how microbes contribute to the formation of							1, 2.							
IV	viruses, Enumera	virus: The nature of Viruses infecting proating viruses and , Morphology of marine	okaryotes, virus-like	6	sediments. Understand the nature of marine viruses, including those infecting prokaryotes; Learn methods for enumerating viruses and virus-like particles; and explore the morphology of marine viruses.										

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	 Sampling techniques in marine microbiology Estimation of bacterial population from marine samples Isolation of marine actinobacteria Enumeration of total heterotrophic bacteria in sea water Hydrolytic enzyme profiling of the marine isolates. 	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									



ASSAM DOWN TOWN UNIVERSITY

Curriculum and Syllabus

Master of Science in Food, Nutrition and Dietetics

OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.1

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 15th and 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

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. 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: 95

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 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.

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	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-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 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.

Breakdown of Credits

Sl. No	Category		Total number of Credits			
		Skill Enhancement Course (SEC)	1			
1		Ability Enhancement Course (AEC)	6			
	University Core (UC)	Field Training	0			
		Discipline Specific Elective (DSE)	0			
		Value Added Course (VAC)	4			
2	University Elective (UE)	Multidisciplinary Course (MDC)	0			
4	Offiversity Elective (OE)	Value Added Course (VAC)	0			
		Discipline Specific Core (DSC)				
3	Program Core (PC)	Field Training	0			
3	Trogram Core (1 C)	Research /Industry Internship	27			
		Summer Internship	0			
4	Program Elective (PE)	Discipline Specific Elective (DSE)	8			
7	1 Togram Elective (LE)	Value Added Course (VAC)	12			
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	2			
3	racuity core (rc)	Ability Enhancement Course (AEC)	0			
	Total					

Breakdown by categories of courses

Sl no	Category	Credits	%
1	Science	85	89.47%
2	Paramedical	3	3.16%
3	Commerce and Management	7	7.37%
	Total	95	100%

SEMESTER WISE COURSE DISTRIBUTION

	C N	Carrage Carla	Course Title	Course			En	gag	gem	ent	t	Max	imum Marks for			
	S. No.	Course Code	Course Title	Category	L	T	P	S	R	O	С	IA*	SEE*	PE*	Total	
	1	23MSFD111R	Macronutrients	DSC	3	0	0	0	0	0	3	40	60	0	100	
	2	23MSFD112R	Human Physiology	DSC	3	0	0	0	0	0	3	40	60	0	100	
ter I	3	23MSFD113R	Nutritional Biochemistry I	DSC	3	0	0	0	0	0	3	40	60	0	100	
Semester	4	23MSFD114R	Advance Food Science	DSC	3	0		0	0	0	4	40	60	100	200	
S	5	23MSCE111R	MOOCS-CE I	VAC	0	0	4	0	0	0	2	0	0	100	100	
	6	23UMFS111R	Fundamental of Statistics	Research	2	0	2	0	0	0	3	40	60	100	200	
	7	23MSFD115R	Mini Research(R1)	Research	0	0	0	4	6	0	2	0	0	100	100	
	8	23UMPD111R	Effective English	AEC	0	0	4	0	0	0	2	0	0	100	100	
		Tota	al								22				1000	
	S. No.	Course Code	Course Title	Course						ent	t	kimum N	Marks for			
	5.110.		Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total	
	1	23MSFD121R	Micronutrients	DSC	3	0	0	0	0	0	3	40	60	0	100	
	2	23MSFD122R	Nutritional Biochemistry II	DSC	3	0	2	0	0	0	4	40	60	100	200	
	3	23MSFD123R	Public Nutrition	DSC	3	0	2	0	0	0	4	40	60	100	200	
	4	23MSFD124R	Food Microbiology and Food Safety	DSC	3	0	0	0	0	0	3	40	60	0	100	
er II	5	23MSFD125R	Techniques of Packaging	SEC	0	0	2	0	0	0	1	0	0	100	100	
Semester	6	23UMPD121R	Communication Mastery	AEC	0	0		0	0	0	2	0	0	100	100	
Sel	7	23MSFD126R	Generic electric	VAC	2	0	0	0	0	0	2	40	60	0	100	
	8	23UUHV101R	Universal human Values	VAC	1	0	2	0	0	0	2	0	0	100	100	
	9	23UMRM121R	Research Methodology and Statistical Analysis	Research	1	0	0	4	0	0	2	40	60	0	200	
	10	23MSCE121R	Moocs-CE II	VAC	0	4	0	0	0	0	2	0	100	0	100	
	11	23MSFD127R	Mini Research(R2)	Research	0	0	0	4	12	0	3	0	0	100	100	
		Tota	al								28				1400	

	S. No.	Course Code	Course Title	Course			Enş	gag	eme	ent		Max	ximum	Mark	s for
	5. 110.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1	23UMPD211R	Corporate Competency	AEC	0	0	4	0	0	0	2	0	0	100	100
	2	23MSFD211R	Advance Nutrition	DSC	2	0	0	0	0	0	2	40	60	0	100
	3	23MSFD212R	Product Development and Marketing	SEC	0	0	2	0	0	0	1	40	60	0	100
	4	23MSFDCE211R	MOOCS-III	VAC	0	0	4	0	0	0	2	0	100	0	100
III	5	23MSFDCE212R	MOOCS-IV	VAC	0	0	4	0	0	0	2	0	100	0	100
r I	6	23UMRE211R	Research Ethics	Research	1	0	0	0	0	0	1	0	0	0	100
Semester	7	23MSFD213R	Mini Research (Survey/Experiments- R3)	Research	0	0	6	4	0	0	4	0	0	100	100
S	8	23MSFD214R	Generic elective	VAC	2	0	0	0	0	0	2	40	60	0	100
	9	23UUFL202R	Personal Financial Planning	SEC	0	0	2	0	0	0	1	0	0	100	100
			select sub	jec	ts fi	ron	or	ie g	rou	ip)				•	
			T	Group I							1	1		1	
	10	23MSFD215R	Applied Nutrition I	DSE	3	0	2	0	0	0	4	40	60	100	200
	11	23MSFD216R	Clinical Nutrition I	DSE	3	0	2	0	0	0	4	40	60	100	200
				Group II							•			•	
	12	23MSFD217R	Applied Nutrition II	DSE	3	0	2	0	0	0	4	40	60	100	200
	13	23MSFD218R	Clinical Nutrition II	DSE	3	0	2	0	0	0	4	40	60	100	200
		Tota	1								25				1300
	S. N.	Course Code	Course Title	Course		-	Eng	gag	eme	ent	-	Max	ximum	Mark	s for
_	S. IV.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
r IV	1	23MSFD221R	Internship	DSC	0	0	0	24	0	0	6	0	0	100	100
Semester	2	23MSFD222R	Research/Data Analysis/ Documentation-R4	Research	0	0	20	4	6	0	12	40	60	0	100
S	3	23MSFDCE221R	MOOCS-V	VAC	2	0	0	0	0	0	2	0	100	0	100
		Tota								20				300	
		Total For Four	Semesters								95				4000

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

			SEMESTER	- I								
Course T	itle		MACR	ONU'	TRIEN	T						
Course c	aho	23MSFD121R	Total credits: 3	L	T	P	S	R	O/F	(С	
			Total hours: 45T	3	0	0	0	0	0	3	3	
Pre-requi		Nil	Co-requisite				N					
Program			Master of Science in l									
Semest	er	1 To inter-description	Fall/ I Semester of fi			ie pro	gramı	me				
Course	e	1. To introduce the students to the basics of nutrition.										
Objectiv	ves		2. To study the basic food groups, cooking methods in details.3. To learn the new concept of nutrients									
CO1			e on different macronutr	ient								
CO2			nt macronutrient deficie		ınd the r	elated	cause	s ·				
CO ₃			gram and policies in co	•								
CO4		•	omposition and recomm						fferent ag	e groi	ups	
CO5			the sources of different							3.21	T. "	
Unit-	[Contact							
No.		Cor	ntent		Hour	I	Learni	ing Ou	utcome	K	ΚL	
	Intro	oduction to Nutritio	on Science - Definitions	,								
	history, and nutrition research in India. Methods											
		etermining human nu										
		Description of basic terms and concepts in										
		relation to human nutritional requirements.				Learn about Understand						
		Guidelines and Recommendations -										
		Recommended Dietary Allowances, factors										
		affecting RDA, methods used to derive RDA, determination of RDA for different nutrients.				body composition and						
I		requirements and allowances.			10					1	1,2	
1	_	Body Composition - Significance of body			10	allov	vances	s for di	fferent	1	-,4	
	_	composition and changes through the life cycle.				1 -	age groups changes					
	_	Methods for assessing body composition (both				throu	ugh th	e life c	cycle.			
		classical and recent) and their applications.										
		Energy - Components of energy requirements:										
	BMF	BMR, RMR, thermic effect of feeding, physical										
	activ	activity. Factors affecting energy requirements,										
		ods of										
		suring energy expend										
			ements of individuals			Estir	nating	energ	y			
II	-		of energy metabolism		7		ireme		•	1	1,2	
			l of food intake – role o	I		indiv	viduals	s and g	groups.			
	•	n and other hormone bohydrates - Review										
		ficance of carbohyd										
	_	ls in dietary intake o										
		ohydrates and their i	• •		4.0			d nutri	tional			
III		ary fibre: Types, so	_		10					1,2		
			sistant starch, fructo-			carbo	ohydra	ites				
	oligo	saccharides, other ol	igosaccharides: Chemic	al								
	comp	position and physiol	ogical significance.									

	Glycemic Index and glycemic load.			
	Deficiency and excess of carbohydrates, its			
	relation to human health.			
	Proteins – Metabolism of Protein, overview of			
	role of muscle, liver and			
	G.I. tract in protein metabolism, Nutritional requirements.			
IV			Understand nutritional	
	Amino acid – Essential and Non-essential of	9	significance of Protein	1,2
	amino acids, therapeutic applications of specific		significance of Protein	
	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	
\mathbf{v}	PUFA: functions and deficiency. Role of n-3	9		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						

		SEMESTER – I										
Course T	Title		HUMAN					•		_		
Course c	ode	23MSFD112R	Total credits: 3	L	T	P	S	R	O/F	C		
D.	• • •	N 703	Total hours: 45T	3	0	0	0	0	0	3		
Pre-requ		Nil	Co-requisite				N					
Program			Master of Science in									
Semest	er	1 To introduce the	Fall/ I Semester of					ne				
Cours Objectiv		2. To understand h there metabolism	e students the basics of ow the various physican. The metabolism of diffe	ological 1	func	tion of o	differe		of the bo	dy and		
CO1		Understand the bas	ics of human physiolo	ogy								
CO2		the food	ctioning of the variou						_			
CO3		food	on the rheological pr	operties,	its :	measure	ment a	ina its i	аррисато	n to		
CO4		body	general organization				erties o	f all the	e systems	in our		
CO5		Understand and app	oly the knowledge of			nealth				_		
Unit- No.		Conte	nt	Contac Hour		Le	earnin	g Outo	come	KL		
I	hum	eral Physiology: On an body, cell structures and functions.	~	6 Understand basic organization of human body					n body	1,2		
II	Con Stru RBC	od: Blood volume an apposition and function cture and formation C, WBC and platelets ma, blood coagulation	ons of blood, and function of s, Haemoglobin,	7	Learn about structure, composition and function blood				1,2			
Ш	Dige orga Mov varie func gast: secre and	ral introduction, gestive system, and functions of mposition, of salivary, inal and biliary ver, gall bladder and absorption of	10		Learn a System		igestiv	e	1,2			
IV	orga Reg exch vent	carbohydrate, protein and fat. Respiratory System: General organization, Mechanics of respiration, Regulation of respiration, Gaseous exchange in lunge and tissues, Pulmonary ventilation, volumes and capacities, Effect of exercise on respiration, hypoxia.				Learn about Respiratory System						
V	Cardiovascular system: General organization, structure and properties of cardiac muscles, Cardiac output, cardiac cycle, conducting system of heart, Heart sounds, regulation of H.R., pulse, blood pressure and its regulation,			12		Learn a System		Cardiov	ascular	1,2		

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	BIO	CHEM	IISTR	Y-I					
Course		23MSFD113R	Total credits: 3	L	T	P	S	R	O/F	C		
Course	code	Total hours: 45T 3 0 0						0	0	3		
Pre-req	uisite	Nil	Co-requisite			I.	N	il				
Progra	mme	I	Master of Science in Fo	od N	utritio	on and	Diete	tics				
Seme	ster		Fall/ I Semester of fire	st yea	r of th	ie pro	gramn	ne				
Com	•	1. To review about t	he different biochemica	l met	abolisr	n react	tion of	the bo	dy.			
Cour		2. To understand ho	w this metabolism takes	place	e in co	rrelatio	on with	the nu	ıtrients.			
Object	iives	3. To understand diffe	3. To understand different pathways involved in nutrient metabolism.									
СО	1	Understand the basic	es metabolic reaction of	the b	ody.							
	_	Give a clear picture	of the biochemical Para	metei	s of th	e body	in no	rmal ar	nd disease			
CO	2	Give a clear picture of the biochemical Parameters of the body in normal and disease condition.										
GO.	•	Understand the concept of solutions of solid in liquid and liquid in liquid and										
CO	3		d to the concentration of		•	1		•				
CO	4	•	t pathways involved in			abolisi	m					
CO	5		d electrolyte balance									
Unit-			<u> </u>	Co	ntact							
No.		Conte	ent		lour	I	Learni	ng Ou	tcome	KL		
	Carb	ohydrates- Definitio	n, classification.									
		ture (linear) of Mono										
		ose and galactose; Dis										
		ctose and sucrose; Polysaccharides- Starch and				Learn short Mat 1 1						
I		lycogen. Metabolism- Glycolytic pathway,			9	Learn about Metabolism of carbohydrates						
		lectron transport chain and oxidative				of ca	rbohy	drates		,		
		phorylation. Metabolis										
		lysis and tricarboxyli										
		shunt.	•									
	Prote	ein- Definition, classic	fication, structure,									
	physi	cal properties, chemic	cal properties and									
	utiliz	ation. Metabolism of	proteins:-									
	Trans	samination, deaminati										
	urea o	cycle. Enzymes and c	o-enzymes-			T		.4 Ma4a	la a 1: a.u.a			
II	Defin	nition, types, classifica	ation and factors		10			it Meta	DOHSIII	1,2		
	affect	ting velocity of enzyn	ne catalyzed reactions.			or pr	rotein					
	diagn	ostic value of serum	enzymes - Creatinine									
	kinas	e, Alkaline phosphata	se, Acid phosphatase,									
	LDH	, SGOT, SGPT, Amyl	lase,									
	Lipas	e, Carbonic anhydras	e etc.									
			cation and properties.			Lear	n abor	ıt Meta	holism			
III	Meta	bolism- Oxidation and	d biosynthesis of fatty		7	of li		ii ivicia	OOIISIII	1,2		
	acids	. Ketone bodies, ketog	genesis and ketosis.			Of H	più					
		- base balance- Acid										
			f buffers, principles of									
		rs, major sources of a	•			Lear	n ahor	ıt acid l	hase			
IV	-	, physiological buffer	· ·		10					1,2		
••		ent buffer systems. F	-		- V	balance and Fluid and electrolyte balance						
			ids in the body, ECF,				.101ytC	Juliio	-			
		Water metabolism,										
		dration 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.	9	Learn about general function of hormones	1,2
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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 F	OOD SC	IEN	ICE					
Course c	ode 23MSFD114R	Total credits: 4	L T	F	•	S	R	O/F	C	
Course c		Total hours: 45T+30P	3 0	2	2	0	0	0	4	
Pre-requ		Co-requisite					Nil			
Program		Master of Science in Fo								
Semest		Fall/ I Semester of first		the	pro	gran	nme			
Cours	Δ ,	To study different food group and their component								
Objectiv	2. To study physic	cal and chemical properties								
	3. To study the var	rious cooking methods of dif								
CO1		to advance food science an	d function	of	diffe	erent	kinds o	of		
	-	ition and classification								
CO2		edge of toxic components in	-							
CO3		pply the knowledge of food	l nutrient b	by so	elect	ing 1	foods fr	om		
		ups in planning of diet.								
CO4		processing and storage skill				ts				
CO5	Develop culinary	skills to satisfy sensory and	1		as				T	
Unit-	C	ontent	Contac	t	L	eari	ning Ou	ıtcome	KL	
No.	G 1 1 1 1 G	•.•	Hour							
	Cereals chemistry: Str	•								
	nutritive value of ceres	-								
		acteristics of starch, use in		,	To learn about structure,					
I	variety of preparations	1 10		composition and nutritive				1,2		
	_	omposition, Selection and variety, use in variety f preparation, nutritional aspects and cost, effect				e of o	cereals	and pulses		
							-			
	of cooking & storage	•								
	Toxic constituents of p	: Composition & nutritive								
	value, physical proper	_								
II		. Milk Processing, Milk	7	,	To le	earn	about c	omposition	1,2	
11	products, Substitutes,	. Will I focessing, will	,	;	and nutritive value of milk					
	Role of milk in cooker	V								
		osition & nutritive value,								
	selection and storage,									
	~	le meat, composition &								
		on of meat, postmortem								
		ooking, storage, factors					about t			
III	effecting tenderness of		10			_		l nutritive	1,2	
	Egg- Structure, compo				valu	e of	Poultry	& Fish		
		eggs, uses of egg in food								
	~	egg Baking - Types of								
	bake products & its nu									
		Classification, composition		\top						
	_	ortance in human nutrition,								
	storage, cooking of ve				Тс 1	20***	ahant t	v.no.c		
	vegetables and fruits of	on cooking, effects of heat,					about t			
IV	acids & alkali. Phytoni	atrients in fruits and	10			_		l nutritive	1,2	
	vegetables				vaiu fruit		vegetat	oles and		
	Spices and Condiment	s: Types, uses in Indian			11 UIl	.3				
	recipe Beverages: Cof	fee, tea, and cocoa,							ļ	
	processing composition	n and preparation								

V	Nuts & oilseeds, Nutritive value of commonly used nuts & oil seeds in our diet, Fats& Oils-Nutritive values, types of fats & oils, role of fat in cookery. Sugar and Related Products: Nutritive value, Properties, characteristics & uses, sugar cookery, Form of sugar and liquid sweetness, Caramelization, Hydrolysis, Crystallization.	8	To learn about types, composition and nutritive value of Nuts & oil seeds	1,2
VI	Standardization of Cereal and pulses recipe and determine the nutritive value Standardization of egg, meat and product recipe and determine the nutritive value Standardization of vegetables, spices and fats and oil recipe and determine the nutritive value Market survey on different types of cereals and pulse (s) Market survey on different types of meat and milk products	45	To apply theoretical knowledge	1,2,3,

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					1		1
Course	e code	23MSFD121R	Total credits: 3	L	T	P	S	R 0	O/F	C
D.	• • •	N701	Total hours: 45T+30P	2	0	2	0	0	3	
Pre-rec		Nil	Co-requisite	I NI-	_4•4	• 1	N D:-4-			
Progra Seme			Master of Science in Fo							
Seme	ester	1 Help to unders	Fall/ I Semester of first						and scien	ntific
Course Objectives		 Help to understand the role of statistics in data analysis, decision-making, and scientific research Introduce students to descriptive statistics, including measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation). Teach students how to summarize and present data effectively using tables, charts, and graphs 								
CO)1		standing of Descriptive Sta	tistics	and	Demogra	aphy.			
CO)2	2. Develop know methods.	ledge to understand the Pro	babilit	ty the	eory, Dis	tribu	tion, an		
CO)3	analysis.			11	J P Stilloon			210106100	
CC)4	v	ledge to understand the prin	nciples	s of v	arious st	atisti	cal anal	yses of da	ata.
CO)5	5.Develop know	ledge on R language for da	ta anal	lysis					
Unit- No.			Content			Contact Hour		Learn	_	KL
I	concep quanti	Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio.				5	Und of S	indatior derstand Statistic ncepts	ding	1,2
II	Presentation: tabular and graphical, including histogram andogives. Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, skewness and kurtosis				5	Pro Pre		y in Data on and	1,2	
III	Bivaria multip	ate data: Definition le correlation (3 va	n scatter diagram, simple, pa ariable only), rank correlation	n, sim	ple	5	Ana Biv	owledge alyzing ariate I ationsh	Data and	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	Pro Dis	derstand bability tributio	and ns	1,2
V	square test, w	esting of hypothesis, parametric test: t-test, z-test, chi- quare test. Non-Parametric test: One sample Kolmogorov st, wilcoxon Signed test, Mann-Whitney Test, ruskalwalis test				7	Hyp	Statisti	Testing	1,2
VI	Introduction to R - A programming language and environment for data analysis and graphics. Syntax of				30			owledge for data	1,2, 3,4	

 Rexpressions: Vectors and assignment, vector arithmetic,	analysis and	
generating regular sequence, logical vector, character vectors,	visualization	
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		

	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								
Course Title	EFFEC	TIVE ENGLISH (Con			e Eng	ish &	Soft S	kills)			
Course code	23UMPD111R	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					
Programme		Master of Science in I									
Semester	, 10										
		ypes of sentences and the	_								
Course	_	students' vocabulary to en			_	_	_				
Objectives		students with the importa					•				
3	4.To introduce the 3P's (Planning, prioritizing & performing) of Time Management.										
		o English pronunciation				_	•				
CO1		ble students to analysis a				• •					
CO2	Learners will be ab	le to integrate the skills	of rea	ading a	ınd spe	aking	in prof	essional			
	communication.										
CO3	•	e sessions will boosts their									
CO4		out the effective and effi									
CO5		netics and its importance	will im	prove 1	the lear	ners' p	ronunc	iation			
	Module 1- Gramm										
	_	nterrogative and Assert	ive Se	ntence	s, Exc	lamato	ry and	Assertive			
	Sentences										
	ii. Types of Tenses										
	iii.Common Errors										
	iv. Synonyms										
	v. Antonyms										
	vi. Homonyms	Cl-211-									
	Module 2- Reading	O									
	i. Techniques of E	and information from a	toyt "	Tha SC	12D Ta	ohnia	10 Into	rprat tha ta	v t		
	Module 3-Listenii		icai .	rne se	ZSIC TO	cinnqu	ic mici	ipiet the te	Λι		
	i. What is listening	-									
	ii. The Process of 1	-									
		ersely affect Listening									
Ι		een Listening and Hear	ing.								
		portance of Effective Li	-	ıg							
		Listening Process,		C							
	Module 4- Conflict Management										
	i. Definition	S									
	ii. Type of Conflic	t Management									
	iii.Effects of Confl	ict Management									
	iv. Methods to deal	with Conflicts (Negati	ve)								
	Module 5- Time-N	Management Skills									
	i. Introduction To	Time Management,									
	_	portance of Time Mana	ageme	nt,							
	iii.Basic Tips to M										
	· ·	solving activity: A situa			-		student	s and they	will		
	have to tell us how	to handle the situation	or sol	ve the	proble	m.					
	Module 1-Gramm	ıar									
II	I	f Interrogative and Asse	ertive	Senten	ces, E	xclama	atory a	nd Assertiv	ve		
	Sentences										

- ii. Types of Tenses
- iii. Common Errors
- iv. Synonyms
- v. Antonyms
- vi. Homonyms

Module 2- Reading Skills

i. Techniques of Effective Reading

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
- 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.

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							
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								
Course Title		MINI RESEA	ARCH	(R1)					
Course code	23MSFD115R	Total credits: 2	L	T	P	S	R	O/F	C
Course code	25WISF D115K	Total Credits. 2	0	0	0	4	6	0	2
Pre-requisite	Nil	Co-requisite				Nil			
Programme	Master of Science in Food Nutrition and Dietetics								
Semester		Fall/ I Semester of first year of the programme							
	1. Appreciate and understand the importance of importance of various research writing						ng		
Course	and review.								
Objectives	2. Applying the tech	nniques and skill for writir	ig Abst	ract, s	hort co	ommur	nicatio	ns.	
	3. To develop techni	cal writing skills.							
CO1	Develop competence	e in writing and abstractin	g skill						
CO2	Learn to write litera	ture and review							
CO3	Develop competence	e in Project proposal							
CO4	Acquired the knowl	Acquired the knowledge to conduct scientific project							
CO5	Analyze the signific	ant aspect of scientific pro	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		NT						
Course co	odo	23MSFD121R	Total credits: 3	L	T	P	S	R	O/F	С	
Course Co	oue	25WISF D121K	Total hours: 45T	3	0	0	0	0	0	3	
Pre-requi		Nil	Co-requisite				Nil				
Program			Master of Science in Foo								
Semeste	er		pring/ II Semester of fir								
			ortance of micronutrient						. 1:00		
Course			To study about the requirements and importance of different micronutrients in different								
Objectives		stages of life	ut mutuiont intonoctions in 1	aumon ho	.d.						
CO1			ut nutrient interactions in l		oay.						
CO1			on different micronutrien t micronutrient deficience		a mala	tad any	222				
CO ₂			ram and policies in conn								
CO3			on with other nutrients	ection to	1000	and no	aiui				
CO5			on water and electrolyte	balance							
Unit-				Contac	et			_			
No.		Cont	tent	Hour		Lea	rning	Outco	me	KL	
	Fat	t Soluble Vitamins(A	A, D, E and K)								
	His	torical background, F	Food sources,			\	.11.1.				
I	Me	tabolism and function	s Interaction with	10		'o learn 'itamin		rai S	oluble	1,2	
	oth	er nutrients, Requirer	nents, Deficiency and		·	панни	5				
		icity.									
		nter Soluble Vitamin			To learn about water						
		torical background, F									
II		tabolism and function		10	Soluble Vitamins					1,2	
		-	nents, Deficiency and								
		icity. icro Mineral (a. Calc	ium and Dhaenharus								
		Magnesium, c. Sodiur	_								
		Chloride)									
III		storical background, F	Good sources.	10		o learn		macre	0	1,2	
		tabolism and function		20	n	ninerals					
			nents, Deficiency and								
	tox	icity.									
	Mi	cro Mineral (a. Iron,	b. Copper,								
	c. N	Manganese, d. Iodine,	e. Fluoride, f. Zinc,								
	g. S	Selenium, h. Cobalt, i	Chromium,								
IV		(Iolybdneum)		7	To learn about micro)	1,2	
1		torical background, F		,	n	ninerals				1,2	
		tabolism and function									
		-	nents, Deficiency and								
		icity	Dalamas Disc 11 - 12 - C		_						
		-	Balance -Distribution of		 -	'o 100m-	o h ov-4	wete-	ond.		
V		ly water, ECF/ICF, fu	ns, thirst mechanism,	8		'o learn lectroly		water	anu	1,2	
		ter/electrolyte balance				iccu01y	ic				
	wal	car caccarolyte barafict	, water-initialance								

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	[
Course	Title		NUTRITIONAL B	ОСН	EMIS	TRY-	II					
Course	anda	23MSFD122R	Total credits: 4	L	T	P	S	R	O/F	C		
Course	coue	25WIST D122K	Total hours: 45T+30P	3	0	2	0	0	0	4		
Pre-req	uisite	Nil	Co-requisite				Nil					
Progra			Master of Science in Foo									
Seme	ster		Spring/ II Semester of fir									
			1.To review about the different biochemical metabolism reaction of the body.									
Cou		food	2. To understand how this metabolism takes place in co-relation with the nutrients of the									
Objec	uves		a higghamical alterations is	dofia	ionović	licardo	>* 0					
CO	11		ne biochemical alterations in sics metabolic reaction of t		•	nsorae	ers.					
CO	/1		picture of the biochemical		•	f tha 1	ody i	n nort	mal and	dicasca		
CO	2	condition	picture of the biochemical	r ai aii	icicis c	or tile i	bouy II	11 11011	iiai aiiu	uisease		
CO	3		emistry behind chromosom	al disc	orders							
CO			f biochemical alteration in			isorde	rs					
CO			emical aspects of some vita				15					
Unit-	<u> </u>	Chacistana croche	simear aspects of some vita		ontact	Ī						
No.		Con	ntent		Hour	L	earnir	tcome	KL			
1100	Intro	duction- DNA, RNA	A, Genetics Biochemistry	+-	1041							
		ind chromosomal disorders:					rn abo					
I		n syndrome, Triple-X syndrome, Turner			10	Biochemistry behind chromosomal disorders			1,2			
		ome, trisomy18, tris	·			chro	omosoi	mal di	isorders			
	Free	radicals and reacti	ve oxygen species: types,									
			kers of oxidative stress		Learn about Free							
II	Antio	xidants: types and s	sources, antioxidant		8	radicals and reactive				1,2		
	defens	se system, combatin	g free radicals and			oxy	xygen species					
	1	ve oxygen species										
	_	-	s: types, functions, active						es and			
III	-	0.	netics and inhibition, use		10		ction o		ymes	1,2		
		estigation, role of co	*				coenz					
			n deficiency disorders:		_							
IV		VADD/ Anaemia,			7					1,2		
			•					•	sorders			
		-	-									
V					10			-	pects of	1,2		
	_							/ital				
				+		COII	ibonen	.13				
	_											
		-			Plar	and c	arry 4	out	1 2			
VI	_	-			40			-	Jui			
	_					CAP	C11111C1			3,7		
			•									
	Bioch Fiber, Omeg immo 1.Qua 2.Qua 3.Qua 4.Qua 5.To s	cholesterol, prostage a-3 fa, Hb, glycocil noglobulins, elastin litative Tests for Ca litative Tests of problitative test for Lipid litative determination at the study the general prostage.	glandins, lipoproteins, ated Hb, , collagen, myosin, keratin arbohydrate teins			Learn about Biochemical alteration in deficiency disorders Learn about Biochemical aspects of some vital components Plan and carry out experiments				1,2 1,2, 3,4		

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						

Com	T:41		SEMESTER – I		יבווקן	ттог	т				
Course	Title		PUBLIC HEAL						0.75	Τ.	
Course	code	23MSFD123R	Total credits: 4	L	T	P	S	R	O/F	(
Due nee		NT21	Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-req		Nil	Co-requisite	- J NI4			Nil				
Progra			Master of Science in Fo								
Seme	ster		Spring/ II Semester of fin				ogramı	me			
Cou	rse	•	different aspect of nutrition								
Objec	tives	2. To study about the importance of child and maternal health.3. To understand the nutritional problems and learn the programmes to combat the problems.									
CO	.1					ogram	mes to	comba	t the pro	Joien	
CO)1		fferent aspects of commun				1:	1.4.4.4			
CO	2		picture of importance of h	eaith pi	rogra	ms po	nces re	iatea t	o mater	nai a	
CO	2	child health	1	1	1 1	41		l: C			
CO	3		dge of nutrition science to					_		•,	
CO	4		nowledge on nutritional pr	roblem	s and	comp	lication	is on c	ommun	iity	
		level				11		1.			
CO	5	Learn about nutrit	ional programmes running			well	as in In	dıa			
Unit-		Con	tent	Conta		Lea	arning	Outco	me	KI	
No.				Hou	r						
		tion and health: N									
			l problems in global as								
		s in India- deficienc									
		alnutrition: Causes, effects of malnutrition.									
		alence, epidemiology. Hidden hunger,					4				
_		nin deficiency- A, B1, B2, Niacin, C, D - lence, programmes to combat, Nutritional					about 1				
I	_		10					1,2			
		•	sis- Prevalence, causes,			malnu	itrition				
		oms and programm									
		MMR, Mortality, m	•								
		ex ratio and poverty									
		•	ealth services and their								
		preventing commu									
			th: Nutritional care in								
		•	y , LBW, Programmes				4				
**			onal requirements in	0			about 1			1 /	
II		•	act of diet on outcome	8		lactati	n Pregn	ancy a	.na	1,2	
		gnancy, MCH	a. Infant faading aafatu			iactan	OII				
		-	s: Infant feeding, safety								
	-	sment of nutrition	utrient supplements.								
		ency disorder.	, clinical symptoms of								
III		ency disorder. tion education: Me	rite planning	10		Learn	about			1,2	
111			ducational techniques,	10		nutriti	onal as	sessme	ent	1,4	
		communication med	-								
		, young child feedir	•								
			levelopment, national			Ного	an insig	rht on			
			objectives, guidelines				an msig ion and	•	nal		
IV		rust areas. PDS - Pi	-	7			opment			1,2	
14	l and fil	rust areas. I Dis - Pl	ione distribution			uc vel	չհուցու	, manoi	ıaı		

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	 Conduct socio-economic survey Conduct diet survey Conduct clinical examination: Planning, conducting and Evaluating Nutrition Education Programme Impact of Government health programmes 	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	I	OOD MICROBIOLO	OGY	AND	FOOD	SAF	ETY			
Course co	aho	23MSFD124R	Total credits: 3	L	T	P	S	R	O/F	C	
Course Co	oue	25WIST D124K	Total hours: 45T	3	0	0	0	0	0	3	
Pre-requi		Nil	Co-requisite					Nil			
Program					ood Nutrition and Dietetics						
Semeste	ı o v o										
		1. To study about different microbiological aspects of the food.									
Course		2. To understand the principles of food preservations and food safety.									
Objectiv	es	3. To understand the positive and negative reaction of the microbes on food and human health.									
CO1		Understand the diffe	rent principles of food	safety	7.						
CO2		Give them a clear pi	cture of role in food pr	eserva	ation a	and foo	d spoi	lages.			
CO3		Apply the knowledg	e of microbiology on f	ood p	roduct	develo	opmen	t			
CO4		Know about principa	les of Food Preservatio	n by t	ising o	differer	nt metl	hods			
CO5		Acquire knowledge	on food safety enforce	ment a	and co	ntrol a	gencie	es			
Unit-		Conte	ent	Con		L	Learning Outcome			KL	
No.		od and Microorganis		Ho	ur			ing Out	COME		
I	mic gen Foo pres veg proc	abstrate for microorganisms, important nicroorganisms in food microbiology, eneral principles underlying food spoilage. cood Contamination- contamination, reservation and spoilage of cereal products/ egetables and fruits/ meat and meat roducts/ milk and milk products/ canned roducts			Learn about Food and Microorganisms			and	1,2		
П	rem high	nciples of Food Pres loval, anaerobic cond in temperature/ low tend d additives/ radiation	ition, preservation by	8	3	Learn Food l			ples of	1,2	
III	Mic food	ods and Enzymes Procroorganisms - product fermentation, foods roorganisms	ctions of cultures,	1	0	Learn Enzyr Micro	1,2				
IV	non into	od toxicity- bacterial bacterial bacterial food poison oxication, food borne	ning/ infections/ disease outbreaks	7	7	Learn about Food toxicity				1,2	
V	Food Sanitation, control and Inspection- sterilization, microbiology in food sanitation			1	0			Food S	Sanitation, tion	1,2,3	

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	Title		TECHNIQU	JES OF	F PA	ACK	AGIN	G				
Course o	code	23MSFD125R	Total credits:	1 ⊢	L	T	P	S	R	O/F		C
Pre-requ	isite	Nil	Co-requisite		0	0	2	0	U Nil	0		1
Progran			Master of Science in Food Nutrition and Dietetics									
Semest		S	pring/ II Semester	of first	yea	er of	the Pr	ogran	nme			
Course Objectives 1. To provide comprehensive overview of the scientific and technical aspects of f packaging 2. To develop comprehensive understanding of different packaging tests. 3. To understand different types and forms of packaging. CO1 To provide comprehensive overview of the scientific and technical aspects of for packaging. CO2 Understand packaging machinery, systems, testing and regulations of packaging. Learn effect of various environmental factors on the stability of food						of food	od					
CO3		Comprehend the known					•					
CO4		Develop comprehen	sive understanding of	of differ	ent	pack	aging	tests				
CO5		Acquire knowledge	on importance of sel		•	kagin	g relat	ed to f	food pr	oducts.		
Unit- No.		Conter	nt	Conta Hou			Lear	ning (Outcon	1e	K	L
I	Introduction: Importance, definition and function of food packaging, Need of food packaging Role of packaging in extending shelf life of foods.				Learn basics of packaging					1,2,	,3,4	
п	(con there Met cons Plas	es of packaging mate astruction of jars and le mal and mechanical pal (types of base meta struction of metal can tics- substituted olefi- lene, PET, polyamide	pottles, optical, properties of glass), al sheets, s, lacquering), ns, tetrafluro	3		Lea	ırn typ	es of p	oackagi	ng	1,2,	,3,4
Ш	ethylene, PET, polyamides, polyesters. Food packaging systems, product characteristics and package requirements. Introduction of food packaging system. Different forms of packaging. Rigid, semi-rigid, flexible forms of packaging.				is, product cage requirements. ckaging system. aging.			Learn about food packaging systems 1,2.				,3,4
IV	food fruit	_	y products, Fresh Poultry, Sea foods.	3		Learn about packaging system for different food 1,2,3,4				,3,4		
ruits, Vegetables, Meat, Poultry, Sea foods. Package accessories and advances in Packaging technology-Introduction, Active packaging, Modified atmosphere packaging, Aseptic packaging, Packages for microwave ovens, Biodegradable plastics, Edible gums, Coatings.			3				_	caging ent foo	d	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	COMMUNICAT	ION MASTERY (Con	nmur	icati	ve Eng	glish &	Soft	Skills)	
Common and a	2211MDD121D	Total credits: 2	L	T	P	S	R	O/F	С
Course code	23UMPD121R	Total hours: 60P	0	0	4	0	0	0	2
Pre-requisite	Effective English	Co-requisite				Nil			
Programme	Mast	er of Science in Food N	Nutri	tion a	nd Di	etetics	1		
Semester	Sprin	Spring/II Semester of first year of the programme							
	1.To familiarize students	s with the transformation	n of s	enten	ces an	d the a	pprop	oriate us	e of
	prepositions.								
Course		2. To enhance the writing skills in different areas including CV and cover letter writing.							
objectives	3. To convey meaning by	reinforcing, substituting	ig for	, or co	ontradi	icting	verbal		
	communication.	1		,		1	1 1.		
CO1	4. Productivity and perfo			_	ession	iai goa	I achi	evement	•
CO1	Explain prepositions, tag	-		•					
CO2 CO3	Discuss and analyze diff	* *			ımart-				
	Explain effective paragra								
CO4 CO5	Describe SWOT analysi Illustrate non-verbal con	<u> </u>			_	_	•		
Unit	mustrate non-verbal con		_	ige co	псерь	5.			
Omt	I. Use of Preposition	Content L. Use of Propositions							
Module 1-	II. Tag questions								
Grammar	III. Idioms, Phrases and Clauses								
Grammar	IV. Simple, complex, compound sentences								
Module 2-	I. Active and Passive Voice								
Grammar	II. Direct and Indirect Speech								
		ting; avoid ambiguity ar	nd va	guene	SS				
Module 3-	II. Paragraph Writing								
Writing	III. Precise Writing								
Skills	IV. Letter Writing								
	V. Resume, CV and C	Cover Letter							
Module 4-	I. SWOT Analysis								
Self-	II. Self-Regulation- C	Goal Setting							
Management	III. Personal Hygiene	Jour Setting							
Skills		1.0							
		al Communication & B	ody L	∠angu	age,				
Module 5-	II. Elements of Comm	·							
Non- Verbal	III. Types of Body Lat								
Communicat ion-Sciences	-	npact of Body Language nication through Body L		a or e					
of Body	* *	ptic, Introduction to Kir	-	-					
Language	VII. Introduction to Pro	-	.103108	,					
Language	VII. Body Language D		Cleari	ng Se	ssion				
Module 6-	I. Importance,			56					
Group	II. Planning, Element	s, and Skills assessed:							
Discussion	III. Effectively disagre								
(Theory)	•	rizing and Attaining the	Obje	ctive					

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							
Course	e Title	UNIVERSAL	HUMAN VALUES (UH	V) + I	PROF	ESSI	ONAL	ETI	HICS	
Course	e code	23UUHV101R	Total credits: 2	L	T	P	S	R	O/F	C
			Total hours: 15T+30P	1	0	2	0	0	0	2
Pre-rec		Nil	Co-requisite				Nil			
Progra			aster of Science in Food N							
Seme	ester		nter/ II Semester of first y					X 7 A T	I IECI -	1
Cou objec		'SKILLS' to ensure sall human beings 2. To facilitate the developrofession as well as of the Human reality of Universal Human 3. To highlight plausib human conduct, trust interaction with National SKILLS' to ensure sall human reality of the Human reality of Universal Human reality human conduct, trust interaction with National SKILLS' to ensure sall human sensure sall human reality of the Human reality of Universal Human reality human conduct, trust interaction with National Reality SKILLS' to ensure sall human beings 2. To facilitate the development of the Human reality of Universal Human reality human reality of Universal Human reality of Universal Human reality human reality of Universal Human reality human reali		pectivosperit Such a vards v olistic huma	y, which e amon ty base a holist value-b t under n beha	ch are ng stu ed on a tic per pased i standi	dents to den	owar ct un- ve for in a n erms tually	ds life a derstand rms the latural v of ethic y enrich	and ding basis way cal ning
CC) 1		nis course is explorational a				-			olves a
CC)2		l study of the human being ma or value prescriptions.	v18-a-	·vis tile	i iest (JI CXIS	tence	•	
CC			nvestigation and self-explo	ration	and n	ot of	giving	serm	ons.	
Whatever is found as truth or reality is stated as a proposal and the students are verify it in their own right, based on their Natural Acceptance and subsequent Validation.					ts are uent I	facilita Experie	ntial			
CC) 5	_	ploration takes the form of and then to continue withi		_					
Unit No.			Content							
I	Self ValideContRight aspirUnde	 Understanding the need, basic guidelines, content and process for Value Education Self Exploration—what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority 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 								
п	 Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya-Practice Exercises and Case Studies will be taken up in Practice Sessions. Understanding Harmony in the family – the basic unit of human interaction Understanding values in human-human relationship; meaning of Nyaya and program for its 						ly'			
III							;			

- 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

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]	Research Methodolog		nd Sta	tistical	Anal	ysis			
Course co	ode	23UMRM121R	Total credits: 2		L	T	P	S	R	O/F	C
			Total hours: 15T+0	60S	1	0	0	4	0	0	2
Pre-requis	site	Nil	Co-requisite					Nil			
programi			laster of Science in F								
Semeste	r		oring/ II Semester of		-						
Course objective		methodology, included: 2. The course seeks to research literature preparation of a reconstruction of a re	o enhances the student udingtheoryofsciences o enhance the students review in different do search proposal for a natist competency in plant sic knowledge of Research knowledge of Research	andquandqus' ski main maste nning earch	nalitatulls for Concer' the concer' the method	iveandor develor sequentesis projections, ods.	quanti oping ly, it ect/M evalu	tative critica aims t ini re	methoul thing of the device of	odsinreso king thr elop ski n.	ough lls for
CO3		Students will be able	to gain the Skill quest	ionna	aire d	evelopn	nent.				
CO4		Students will be able	to acquire the knowled	dge o	of basi	ic Repo	rt/diss	ertati	on Pro	ocedure.	
CO5		Knowledge on differen	ent IPR rights								
Unit no.		Conte	nt		ntact our	Ι	earni	ing O	utcon	ne	KL
I	me mo of i		of research, ypes and significance od research. roblems- definition essity of defining	2	Knowledge on fundament concepts of research methodology, including the meaning and objectives of research			the the	1,2		
II	design, different types of sampling design,				Able the fur research meaning research	ndame ch des ng and	ntal p ign, i l nece	rincip ncludi	oles of ng the	1,2	
III di an an ir		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			3	A good different identification tools f	nt typ y vari	es of ous s	data a	and	1,2
IV		nning and organizing mat of research report	•		3	Able to organize and write a comprehensive research report					1,2

	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			
	Intellectual property right (IPR), Introduction			
	and the need for IPR, IPR in India and			
	worldwide, Patents, Trademarks, Copyright			
	& Related Rights, Industrial Design,		Knowledge on importance of	
V	Traditional Knowledge and Geographical	3	Intellectual Property Rights	1,2
	Indications, Patentable and non-patentable,		(IPR) both in India and	,
	patenting life, Filing of a patent application,		globally	
	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		Knowledge on various	
Practical	5 Analysis of 22 and 23 Factorial Experiment	60	statistical experiments and	1,2,3,
Tactical	6 Simulation-I using R (Bernoulli, Binomial,	UU	simulations using R	4
	Poisson and Geometric distribution.).		Simulations using K	
	7 Simulation-II using R (Exponential and			
	Normal distribution).			
	8 Simple random Sampling			
	9 Stratified Random Sampling			

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					

		SEI	MESTER –	III								
Cours	Course Title PERSONAL FINANCIAL PLANNING											
Course	e Code	23UUFL202R	Total Cı	redits: 1	L	T	P	S	R	O/F		
		2500FL202K	Total Ho	0	0	2	0	0	0	1		
Pre- Re	equisite	Introduction to Financial Budgeting And Planning	Co-rec	quisite	Nil							
Progra	mmes	Master of S	cience in Fo	od Nutritio	n and	Diet	etics	5				
Semo	ester	Fall/ III Semester of second year of the program										
		1. The course would offer an inclusive approach to understand the relevant concepts of										
		money, borrowing, lending, taxes and their application to financial planning.										
Cou	ırse	2. Assess the personal financia	al planning p	process, the	life cy	cle o	f fina	ıncia	l plai	ns, and	d	
Objec	ctives	methods of goal achievement.										
		3. Formulate a budget, record-	keeping sys	tem, and tax	x planr	ning s	trate	gy ba	ased	on cui	rent	
		financial goals.										
CO	D1	Explain the cash management	and buying	plan for ho	mes or	auto	mobi	les.				
CO)2	Discuss a diversified investme	ent portfolio	for differen	t objec	tives						
CO	D3	Compare mutual funds, ETFs,	and real est	ate investm	ent opt	ions.						
CO	04	Develop a financial plan for re	etirement and	d estate pro	tection	•						
CO	D 5	Describe financial products an	d strategies	for long-ter	m goa	ls						
Unit		C 4 4		Contact	_		•	<u> </u>				
no.		Content		Hour	L	earn	ing (Jutc	ome	ľ	(L	
	Unit 1	- Fundamentals of Financial l										
	i. Func	unctions of money;										
	ii. Infla	ntion- Meaning, causes, how it										
	control	led;		Stude	ents v	vill b	e abl	e to				
I	iii. pro	i. process official planning,			comprehend the						2,3	
1	iv. Tim	. Time value of money-simple and compound			fundamentals of financ							
	interes	t;			planning.							
	v. Net	Present Value and Future value										
		ver of Compounding;										
	vii. Do	ubling period and Rule of 72.										
		- Income Tax Planning—										
		ning of Income,		Students will be able to								
		ect & Indirect Taxes, Taxable Ir			unde					ne		
II		s heads of Income for tax Calcu	lation,	6	basic						1,2	
		n-taxable Income,			tax a	•						
		evasion and tax avoidance,										
		, Tax Planning Strategies.										
		- Entrepreneurial planning –	• • • •									
		ning of Entrepreneurship, prere	quisites for									
		ing an entrepreneur,	to To Ata		C4 1		.:11 1.	1.1	- 4 -			
		epreneurship Support Systems	ın ındıa,		Stude							
III		itutional support systems for		6	under				_	1	1,2	
	_	reneurs,		scope		_	_	snes	OI			
	iv. Financial support systems for entrepreneurs;v. Venture Capital, Business Angels,			entre	prene	ursn	ıp.					
		istant of Government,										
		nstant of Government, mmercial Bank Loans and Ove	rdraft									
		-Planning for investing in sec			Stude	nte r	vi11 h	e ahl	e to			
IV	marke	_	urtues	6	Students will be able to						3,4	
	шагке			analyze and interpret the								

	i. Investment avenues offered by Securities		different dimensions of	
	Markets,. Primary Market and Secondary Market,		stock market investment.	
	ii. Stock market- meaning, features, functions of		Stock market myestment.	
	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.			
	Unit 5- Planning for debts and Retirement			
	i. Consumer credit - Introduction to consumer			
	credit; choosing a source of credit, the cost of			
	credit alternatives,		Students will be able to	
	ii. Consumer Legal Protection;		evaluate the aspects of	
v	iii. Housing Decision: Factors and Finance;	6	retirement planning to	1,2,3
	Vehicle Decisions.		formulate effective	, ,
	iv. Retirement planning - Meaning of cost of		strategic financial plans.	
	living; retirement need analysis; development of		strategie imaneiai piansi	
	retirement plan, various retirement schemes,			
	v. 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	
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 -										
Course T	itle	CLINICAL NUTRITION I										
Course co	ode 23UMRM121R	Total credits: 4			T	P	S	R	O/F	C		
Course co		Total hours: 45T+30	OP 3	3	0	2	0	0	0	4		
Pre-requi		Co-requisite					Nil					
Program		Master of Science in Food Nutrition and Dietetics										
Semeste		Fall/ III Semester of second year of the program										
Course	a	1. To study about different aspect of diet modification and adaptations.										
Objectiv	2. To study about the	2. To study about the different nutrient modification at different disease state.										
_	3. To learn planning	3. To learn planning and modification of diet in normal and different disease conditions.										
CO1		erent aspect of food nut								-		
CO2		ferent aspect of diet mo				daptat	ions in	disea	ses state	•		
CO3		e on planning of differe										
CO4		ce of therapeutic diet in										
CO5	Evaluate the signific	cance in the modification			t in dif	ferent	feedin	g metl	nods.			
Unit-No.	Conte	nt (Contac		1	Learn	ing O	ıtcom	P	KL		
CIIIt-110.	Conte	iit	Hour				ing O	110111		IXL		
	Introduction to clinical											
I	Introduction, Role of die		5		Role	of dieti	cian			1,2		
	care. Patient Care and Co											
	Adaptation of therapeu											
	Introduction to therapeut	• •										
	• •	ietary adaptation for therapeutic needs,										
	Normal nutrition- a base			Learning of hospital diet,								
	Diet prescription and con	nstructing	10									
II	therapeutic diets	-				-	_			1,2		
	<u> </u>	outine Hospital Diets: Normal or general			different, mode of feeding							
	2	ets, Liquid diets, soft diets.										
	Mode of Feeding: Oral											
	enteral feeding, Peripher											
	Total parenteral nutrition											
	Nutritional management	nt in infections and										
	fever:											
III	Typhoid, Pneumonia and		10		Differ					1,2		
	Nutritional care in weig		10		infecti	ons, w	eight i	nanag	ement	-,-		
	Introduction, underweigh	it, overweight and										
	obesity, PCOS.											
	Nutrional management	in cardiovascular										
	diseases:											
	Dyslipidemia, Atheroscle				. .	11.01			-			
IV	Hypertension, Myocardia		10		Diet n		ations	for C	√D,	1,2		
	Angina Pectoris, Chronic				Diabe	tes.						
		heumatic heart disease, Stroke.										
	Nutrional management	in diabetes										
	mellitus and gout			\perp								
	Nutritional managemen	_										
₹7	intestinal diseases: Dian	*			ТЬ		dict f					
V	Constipation, Gastritis, I	-	10		Thera	•						
	bladder and biliary disor	_			gastro	ıntestii	nai dis	eases				
	Malabsorption Syndron	me- Cenac disease,										

VI (Practical)	Steatorrhoea, Lactose Intolerance, Tropical 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 of nutritive value of: Gastrointestinal tract: Diarrhoea and Constipation 5. Planning, preparations and calculations of nutritive value of: 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: Celiac disease and Crohn's disease 7. Planning, preparations and calculations of nutritive value of: Gastrointestinal tract: Diabetes mellitus	16	Learn different types of hospital diet, Feeding method, diet for CVD, Gastrointestinal disorder, peptic ulcer, Celiac disease and Crohn's disease, diabetes mellitus, gout	1,2
	7. Planning, preparations and calculations of nutritive value of:			

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 – II								
Course Ti	tle		APPLIED N	U TR I	ITIO	ΝI					
Course co	de	23MSFD215R	Total credits: 4	L	T	P	S	R	O /.	F	C
Course co	uc	25115F D215R	Total hours: 45T+30P	3	0	2	0	0	0		4
Pre-requis	site	Nil	Co-requisite					Nil			
Programi	ne	N	laster of Science in Foo	d Nu	tritio	n and	l Diet	etics			
Semeste	r	F	'all/ III Semester of seco	ond y	ear o	f the	progi	am			
Course		1.To study about diff	erent aspect of Food Scie	ence a	and p	rocess	ing.				
Objective		2.To study about the	2. To study about the application of principles of food science in product development.								
Objective	63	3. To learn different te	chniques of food adultrat	ion te	esting						
CO1		Understand the differ	ent application of food so	cience	e in f	ood pi	roduct	ion a	nd pa	cka	ging
CO2			ture of recent trends and						ce and	l te	chnology
CO3		Learn different food s	standard and regulations	govei	ned l	y Ind	lian go	ovt			
CO4		Develop nutrients der	nse food products								
CO5		Analyze different tech	hniques and skill for dete	cting	food	adult	eratio	n.			
TI!4 NI-		C	4	Cor	ıtact	т.		- 0	4		1/1
Unit-No.		Cont	ent	Н	our	Le	arnın	g Ou	tcom	e	KL
	Ro	le of macronutrients:	Role of fiber in lipid								
		tabolism, colon functi									
I	and	and G.I tract functions – Disadvantages of				D _o 1	a of d	انمنامنا			1 2 2
1	Die	etary fiber, Role of satu		5	Role of dietician 1,					1,2,3	
	lipo	oprotein and Triglycer									
	die	diet									
	Standards for foods: Milk and milk products,					Learning of hospital					
II	Fru	Fruits and vegetables, Beverages and Fleshy			10	diet	diet, different, mode				
	foo	foods.				of f	eeding	g			
	Food regulations-Standards and quality										
	cor	control :Principles of quality control- Raw									
	ma	material process				Different types of diet			Ωŧ		
III	Co	Control and product inspections. Food laws and consumerism: Definition,			10	Different types of diet					1,2
111	Foo				LU	for infections, weight					1,2
	Co	Consumer protection, Consumer Education, Legal modes of protection and Machinery for				management					
	Leg										
		ressal of consumer gri									
			Designing new product-								
		es and drawing force,	-								
IV		velopment, stages of pr	•	1	10			ificati		or	1,2,4
• •		ccess in product develo	•	_		CV	D, Dia	abetes			1,2, .
			evaluation in consumer								
	_	duct acceptance.									
		od adulteration and l					_	tic die			
V			ifferent foods, Methods]	10	_		estinal			1,2,3,4
			oods, Food Sensitivity				eases				
		ntroduction to differen					owled	-			
		food processing industries						equip			
		_	e composition- moisture					analy			
VI		_	e composition- protein			_		f prox			1,2,3,4
(Practical)		-	te composition- total ash	1	16		_	ion, S		y	, ,-,-
		Evaluation of proximat	-			evaluation, Storage studies by packaging					
		Evaluation of proximat	-								
	7. I	ntroduction to sensory	analysis and uses of			mat	erials				

sensory tests: Establishing sensory panels,		
Recognition tests for 4 basic tastes, odour and		
aroma., Analytical tests: (i) Difference,		
(ii) Ranking, (iii) Descriptive, (iv) Scoring and		
(v) Rating		
8. Standardization and storage studies of		
developed food products and using 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	le	CLINICAL	NUTR	ITIO	NII								
Course cod	le 23MSFD218R	Total credits:		L	T	P	S	R	O/F	C			
		Total hours: 45T	3	0	2	0	0	0	4				
Pre-requisi		Co-requisite					Nil						
Programm	Ma Ma	Master of Science in Food Nutrition and Dietetics											
Semester	Fa	Fall/ III Semester of second year of the program											
		1. To review about the different biochemical metabolism reaction of the body.											
Course	2. To understand how the	2. To understand how this metabolism takes place in correlation with the nutrients of the											
Objective		-											
	3. To plan meal for diffe												
CO1	Understand the differer												
CO2	Understand and apply of	lifferent aspect of die	t modif	icatio	on and	l adap	tations	s in me	etaboli	c and			
	systemic diseases state												
CO3	Analyse and understand												
CO4	Acquired knowledge or	n the planning diet fo	r differe	ent co	onditio	ons							
CO5	Apply therapeutic diet	for extreme nutrient i	equired	patie	ents.								
Unit-No.	Conten	t	Conta		Ţ	earni	no Oi	itcome	a	KL			
			Hou	r		cui iii	ng Ot	itcom					
	Nutrient and drug intera	ection: Effect of		1	oorn	tha in	morto	aco of					
I	Nutrition on Drug, Drug E	5		Learn the importance of									
	Nutritional Status, Drug as		1	Nutrient and drug interaction									
	NT 4 *4* 1			Learn different types of diet									
II	Nutritional management	10			diet	1,2							
	hematological disorders	and burns		1	or AI	DS							
	Nutritional management	utritional management in hepatic											
	disorders: Viral Hepatitis	lisorders: Viral Hepatitis, Liver Cirrhosis,				Learn different types of diet							
***	Hepatic encephalopathy or	Hepatic encephalopathy or Hepatic coma							1,2				
III	Nutritional management	10		modification for liver and									
	disorders: Asthma, COPI		I	pulmonary diseases.									
	Pneumonia												
	Nutritional management	in renal diseases:											
137	Acute and Chronic renal d	iseases, Nephrotic	Learn different types of						diet	1.2			
IV	Syndrome, Renal calculi,	ESRD, Renal	10	r	nodifi	cation	for re	nal di	seases	1,2			
	Transplantation												
	Nutritional management	in neurological											
	and mental disorders: Ea	ating disorders,		T	_earn	diffor	ant						
v	Alzheimer's disease, Park	inson's disease,	10					ficatio	n for	1.2			
v	Nutritional and holistic ca	re for neurological	10		• •			ficatio	n ior	1,2			
	and mental disorder.			ľ	ieuroi	ogicai	disord	iers					
	Inborn Errors of Metabo	olism											
	1. Planning, preparation as	nd calculation of											
	nutritive value of hepatic	disorders: Viral											
	Hepatitis, Liver Cirrhosis					diat =	odifia	ations	of				
VI	2. Planning, preparation as												
	nutritive value of hepatic		liver disorders, Learn diet						1,2				
(Practical)	encephalopathy or hepatic	coma	16		modifications of Nephrotic disorder								
	3. Planning, preparation as	nd calculation of			иѕога	51							
	nutritive value of pulmona	ary disorders:											
	Asthma, COPD, Bronchiti	s, Pneumonia											

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, 4th 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 Title											
Course code	23MSFD217R	Total credits:	4	L	T	P	S	R	O/F	·	С
Course code	25NISFD217K	Total hours: 45T-	-30P	3	0	2	0	0	0	•	4
Pre-requisite	Nil	Co-requisite					Nil				
Programme	Ma	ster of Science in F	ood Ni	utrit	ion an	d Diet	tetics				
Semester	Fa	ll/ III Semester of s	econd	yeaı	of the	prog	ram				
Course	1. To study a different	aspect of food standa	rds and	d saf	ety.						
Objectives	2. To study the differen	-			ty and	produ	ction.				
Objectives	3. To study the advance										
CO1	Understand the differe					_		_	ckag	ing.	
CO2	Give them a clear pictor			ood	science	e and	techno	logy.			
CO3	Understand the recent	trends of health food	s.								
CO4	Acquired knowledge of			ial.							
CO5	Evaluate the significant	ce of recent food trea	nds								
Unit-No.	Conte	nt	Cont		T a	arnin	g Out	_C Ome		K	Γ,
OHIU-110.			Hou	ır	1.0	WI 1111	s Vui	Come		17.	
	Introduction: Aim and	·									
	Science and Technology				Learn different Constituents						
	Food: Chemical, Physical										
I	Alterations Occurring in	Foods During	5					ents	1,2	2	
_	Processing and Storage				of foo	ds					
	Enzymes of importance										
	processing: Carbohydrat										
	lipases, Oxidoreductases										
	Introduction to advanc	_									
	used in food processing										
	agitation, air classification				Learn technologies used in food processing						
	technology (reverse osm								1,2		
	Filtration), high pressure		4.0					in		2	
II	exchanger, ohmic resista	nce heating, super	10)						2	
	critical extraction.	. a b :									
	Pre and Primary Proce	ssing: Some Basic									
	Concepts Form and this on Comit Pro	one and Enada									
	Fermentation, Semi Pro Instant Foods	ocessea roous,									
	Quality Evaluation of F	ond Paguirament									
	for conducting sensory to	•			Learn	differ	ent tur	es of			
III	limitation of sensory eva		10)	quality				d	1,2	,4
	methods of evaluation of	3			quart	y C van	aution	01 100			
	Food Trends: Changing										
	consumer behavior in, P										
IV	Lifestyle changes: econo		10)	Learn	differ	ent Fo	od Tre	ends	1,4	.5
			10							1,4,5	,-
	influences.	6									
	Food Packaging: Food	packaging-									
₹7	protective packing,		10		Learn different types of					1.2.2	2.4
v	Packaging materials (me	tals, glass, paper	10	,	food p	ackag	ing			1,2,.	3,4
	and plastics) use of pack	aging in extending									
	shelf life of unprocessed	foods (modified									
V	Psychological influences and marketing influences. Food Packaging: Food packaging- Principles in the development of safe and				oes of		1,2,	3,4			

	atmosphere packaging, Biodegradable Plastics). Food Sofety: Food Toying, Food Standards			
VI (Practical)	Food Safety: Food Toxins, Food Standards 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	16	Learning the equipment of processing and preservation, Techniques of heat treatment, Techniques of cold treatment, Techniques of dry treatment, Techniques of extruded products	1,2,3,4
	7. Different methods of drying : Sun drying 8. Preparation of extruded products			

- 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 Title									
Course code	23UMPD211R	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			
Programme		aster of Science in Food Nu							
Semester		I/ III Semester of second yes							
	•	nts with the various tools of a			•			.1	
C	listeners.	aking skill instruct, influence	e, eng	age,	eauca	ite, or	appe	ease the	
Course		iency, presentability and qual	lity of	f rock	ıma a	nd nr	wida	miden	a for
Objectives	_	d self-evaluation in social me	-	ı iest	iiie a	na pro	Viue	guidanc	Æ 101
	_	in the students for the campu		165 &	walk	ring ir	itervi	ews	
CO1		arners to speak with greater c							ners
CO2	* *	e impact in their thought pro-							1015.
	*	nts with all the necessary tool							onal
CO3		earn to highlight and assess th				_	_	_	onar
		n techniques to solve critical)
CO4	_	terviews, improve their com	_					_	
	confidence	, 1				,			
CO5	It will prepare the le	arners to speak with greater c	contro	ol and	l char	isma	in fro	ont of oth	ners.
Unit-No.		Content							
	Module 1-Presentatio	n Skills							
I	i. Introduction								
1	ii. Essential character	istics of a good presentation							
	iii. Preparation of a good presentation								
	Module 2-Public Skill								
	i. Fear of Public Spe	_							
		Overcoming Fear of Public	Speak	king,					
	iii. Confidence and Co	<i>'</i>							
II	iv. Physiology and Str								
	-	ons and Public Speaking,							
		vi. Tips for Using Visual Aids in Presentations,							
	-	iii Policering Presentations Successfully							
	_	viii.Delivering Presentations Successfully, Doubt Clearing and Summary of Main Points							
		ession on Resume, Curricul	lum V	Vitae	Wri	ting c	over	· letter &	
	LinkedIn Profile	cosion on resume, curricul	· ·	Tuuc	, ,,,,,	······································	.0 / С1	ictici c	~
		ssion & screening of Resume	<u>.</u>						
III	•	n cover letter screening session							
		ii. Creating a profile on LinkedIn							
	How to utilize it								
		& Management Skills							
	i. Concepts of Leade	rship,							
	ii. Leadership Styles,								
IV	iii. Manager VS Leade	er,							
	iv. How to be an Effec	ctive Leader,							
	v. Mock/Practice Ses	sion,							
	vi. Doubt Clearing Se	ssion.							

	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,
(1 Tactical)	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:

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 T	Title		ADVANCE NU	JTRITI	ON					
C		22MCED211D	Total credits: 2	L	Т	P	S	R	O/F	C
Course code		23MSFD211R	Total hours: 30T	2	0	0	0	0	0	2
Pre-requ	isite	Nil	Co-requisite				N	il		
Program	ıme]	Master of Science in Food	Nutritio	n a	nd Die	tetics			
Semest	er		Fall/ III Semester of secon	d year o	of th	e prog	ram			
		· ·	fferent concepts of advance	nutrition	anc	l nutrit	ional			
Cours		requirement in spe								
Objectiv	ves	•	e recent trends in nutrient mo					olicati	ons.	
			role of different nutraceutica							
CO1			cacy and importance of function					_		
CO2			ly nutritional knowledge in	various	aspe	cts like	spor	ts nut	rition, s _l	pace
601			e, emergency care etc.	.,.						
CO3			e on recent advances in nutri					1.1	,	
CO4		in human nutrition.	owledge on and metabolic ro	oie oi va	rıou	s nutrie	ents a	na the	ar intera	ictions
CO5			cological actions of nutrient	a and th	oir i	mnligg	tions			
Unit-	<u> </u>	Anaryze the pharma	ecological actions of nutrient	Conta		прпса	nons.			
No.		Co	ntent	Hour		Lea	rning	Outo	come	KL
1100	Con	cept of advanced nu	trition: Application of	11041	11001					
_		rition Principles; Sco	_		Learn the concept of Nutrition and its					
I		ition and Dietetics; C	5							
	nutri	tion.			princip	les				
	Foo	d additives: Function								
	food	products. Chemical,								
	toxic	cological aspects.								
		d fortification and F								
II	-	ectives, principles and	10		Acquired knowledge of food additive					
	_ ~	genetics and Nutrige	10							
		lulating nutrigenom								
		ritional requiremen								
	_	cial nutritional needs								
		rgency care and sea volume runo-nutrition: Con								
III			rent immune-nutrients and	10		Acquir	ed kn	owled	lge of	1,2
111	_	-	rsiological conditions.	10		immun	e- nut	rients		1,2
			ion and types, Efficacy and							
		ty, Dietary and resist								
		•	, Antioxidant and Pro-							
		lant Aspects.			Acquir	ed kn	owled	lge of		
IV	Fun	ctional and bioactiv	10		Functi	onal a	nd bio	oactive	1,2	
	Defi	nition, chemistry, so			compo	nents	of foo	ods		
	pers	pective of food applic	cations for: polyphenols,							
			ycopenes, carotenoids),							
		no-sulphur compoun								
		-	ts for special conditions:			Acquir			-	
V	_	ial nutrition needs fo	•	10				_	ements	1,2
	eme	rgency care, sea voya	ige.			for spe	cial c	onditi	ons	

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 Title PRODUCT DEVELOPMENT AND MARKETING										
Course code		23MSFD212R	Total credits: 1	L	T	P	S	R	O/F	С
Course	coue	25WIST D212K	Total hours: 30P	0	0	2	0	0	0	1
Pre-requ	uisite	Nil	Co-requisite				Nil			
Prograi		N	Master of Science in Food I	Nutri	tion a	nd Di	etetics			
Semes	ter]	Fall/ III Semester of second	d yea	r of tl	ne pro	gram			
Cour	ese		steps in food product develop		t.					
Object	ives	2.To know about the concept of entrepreneurship.3.To study about role and responsibilities of entrepreneur.								
CO	1	Explain the concept	of entrepreneurship							
CO2	2	Learn about entrepre	•							
CO3	3	Explore world of ent	-							
CO4		•	between successful and failed		•					
COS	5	Understand the value	es and attitudes of successfu	l entr	eprene	eurs				
Unit- No.		Con	ntent		ntact Iour	Lea	arning	g Outo	come	KL
I	Introduction on developing various food products and selection of target group. Market survey and Preparation of questionnaire.				2		rn to d	•		3,5
II		dardization of recipe, attion.	Preparation method, sensory		2	1	nulate stionn	aire		1,2
III Shelf life, packaging, labeling, costing, storage, transportation and distribution, advertising 2				2	met	ndardiz hod & kaging	Diffe		1,2,3	
IV	produ	-	tion of the developed	2 Skill of marketing					ng	1,4
V	Repo	ort writing and Present	ation.	2 Documentation					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		RESEARCE	H ET	HICS	5						
Course	Code	23UMRE211R	Total Credits: 1	L	Т	P	S	R	O/F	C		
			Total Hours: 15T	1	0	0	0	0	0	1		
Pre-Requ		NA	Co-Requisite				NA					
Program			Master of Science in Food									
Semes	ter		Fall/ III Semester of seco						1.			
			se of integrity in data colle			•			<u> </u>	0		
		_	eed of honesty, transparer	icy a	na acc	ountai	omity	ın res	earcn			
Cour	00	practices.	e related to authorship, pul	hlion	tion of	hios r	oor r	oviow	and th	0		
Objecti			voiding research miscondu			_						
Objecti	ives	plagiarism.	volunig research miscondi	act III	Ke uai	a rabii	cano	11, 1415	meanoi	i anu		
			cal thinking and ethical de	ecicio	n_ ms	king e	bille	to nav	rigate co	mnlev		
		_	os, balancing scientific pro			_			-	_		
CO1			y research ethics theories				Ct 101	Cuiic	ai norm			
CO2		** '	thics issues such as respon				and r	niscor	duct			
CO3		_	ts and results in ethical res				and i	inscor	iduct.			
CO4			procedures for sampling,				nd re	nortin	ισ			
COS		•	ciples to research design a				ina re	portin	.6.			
Unit no.		1 appriy comoun prim	Content									
	ETHI	ICS: Introduction to			introd	uction	to m	oral tl	neory.			
		ICS: Introduction to the course and each other; an introduction to moral theory. s: definition, moral philosophy, nature of moral judgements and reactions. Research										
I		ation; self – regulation; research ethics. Honesty, candor, compromise and integrity.										
	_	ownership and stewardship; conflicts of interest; collaboration. Human and Non-										
		-	h and researchers in societ									
	SCIE	NTIFIC CONDUC	CT- Ethics with respect to	scier	nce an	d resea	arch.	Intelle	ectual			
***	hones	sty and research integrity. Scientific misconducts: Falsification, Fabrication, and										
II	Plagia	giarism (FFP). Redundant publications: duplicate and overlapping publications, salami										
	slicing	cing. Selective reporting and misrepresentation of data										
			CS- Publication ethics: def						-			
	•	practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of										
III		sterest. Publication misconduct: definition, concept, problems that lead to unethical										
		haviour and vice versa, types. Violation of publication ethics, authorship and contributor										
	_	hip. Identification of publication misconduct, complaints and appeals. Predatory publishers										
		ournals.	TOTTING O	1		1	. ,.					
			SHING-Open access pub						1: -:			
IV		RPA/RoME0 online resource to check publisher copyright & self-archiving policies.										
					re tool to identify predatory publications developed by SPPU. Journal finder / journal ion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.							
			ONDUCT Group Discuss							FFP		
			nterest. Complaints and ap			-						
		_	se of plagiarism software	_		_						
		e software tools.	or pragramom soremare			, 01			oner ope			
V			SEARCH METRICS-Da	ataba	ses: Iı	ndexin	g dat	abases	s. Citati	on		
			e, Scopus, etc. Research M				_					
			SNIP, SJR, IPP, Cite Score			_		-		_		
	altmet	_					-					
<u> </u>												

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	23MSFD213R	Total credits: 4	L	L T P			R	R O/F	
Course code	25WIST D213K		0	0	6	4	0	0	4
Pre-requisite	Nil	Co-requisite		Nil					
Programme	Master of Science in Food Nutrition and Dietetics								
Semester	Fa	Fall/ III Semester of second year of the programme							
Course Objectives	2. Applying the tech	_	ing abst	of various research writing and review. ng abstract, short communications. w literature.					
CO1	Develop competen	ce in writing and abstract	ing skil	1					
CO2	Learn to write liter	ature and review							
CO3	Develop competence in Project proposal								
CO4	Acquired the knowledge to conduct scientific project								
CO5	Analyze the signifi	cant aspect of scientific p	roject						

	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					

	SEMESTER – IV								
Course Title	INTERNSHIP								
Course code	23MSFD221R	Total credits: 6	L	T	P	S	R	O/F	C
Course code	25W15F D221K	Total Credits: 0	0	0	0	24	0	0	6
Pre-requisite	Nil	Co-requisite				Ni	il		
Programme	N	Iaster of Science in F	ood N	Tutriti	on and	l Diete	etics		
Semester	Fall/ IV Semester of second year of the program								
	1. To gain hands on	experience of workin	g in v	arious	institu	tions r	elated	to the area	of
Course	Food and Nutriti	on.							
Objectives	2. To learn the inter	relationship and intra	a-relationship between the employee						
	3. To understand ma	anagement in work pla	ce						
CO1	Extend field exper	ience to apply therap	eutic	interv	entio	n strate	egies i	n hospita	1/
COI	industry setup								
CO2	Apply therapeutic	knowledge and acqu	ire pr	actica	l skill	s in the	e field	of expert	ise
CO3	Evaluate and mana	age hospitalized pati	ents w	vith nu	ıtritio	n inter	ventio	n strategi	es
CO4	Analyze thoughtful assessments and plans for evaluation and management in the								
CO4	work environment								
CO5	Identify the scope	of exposure and emp	loyme	ent op	portur	ities i	n relev	ant 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

Date/Time	IPD/OPD Posting	Counselling details

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								
Course Title	RES	SEARCH/ DATA ANA	LYS	IS/ DO	CUM	ENTA	TION		
Course code	ourse code 23MSFD222R Total credits: 12	Total anadita, 12	L	T	P	S	R	O/F	С
Course code		0	0	20	4	6	0	12	
Pre-requisite	Nil	Co-requisite				N	il		
Programme	N	Master of Science in F	ood N	utriti	on and	Diete	tics		
Semester		Fall/ IV Semester of so	econd	year	of the]	progra	am		
	1. Appreciate and un	derstand the importance	e of in	nporta	nce of	variou	s resea	rch writing	g and
Course	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 literat	ure and review							
CO3	Develop competence	e in Project proposal							
CO4	Acquired the knowle	edge to conduct scientif	ic pro	ject					
CO5	Analyze the signification	ant aspect of scientific	orojec	t					
Unit-No.		C	onten	t					
	Introduction								
	Review of literature								
	Materials and metho	ds							
I	I Results and Discussion								
	Summary								
	Annexure/Appendic	es							
	Presentation of the 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 Zoology

OUTCOME BASED EDUCATION FRAMEWORK CHOICE BASED CREDIT SYSTEM

Version: 2.1

FACULTY OF SCIENCE

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 15th & 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023

Chairperson, Board of Studies

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

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: 98

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 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 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
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.

Breakdown of Credits

Sl. No	Category		Total number of Credits			
		Skill Enhancement Course (SEC)				
		Ability Enhancement Course (AEC)	3			
1	University Core (UC)	Field Training				
		Discipline Specific Elective (DSE)	10			
		Value Added Course (VAC)	2			
2	University Elective	University Elective Multidisciplinary Course (MDC)				
2	(UE)	Value Added Course (VAC)				
		Discipline Specific Core (DSC)	28			
3	D C (DC)	Field Training				
3	Program Core (PC)	Research /Industry Internship	19			
		Summer Internship				
4	Program Elective (PE)	Discipline Specific Elective (DSE)	14			
4	Flogram Elective (FE)	Value Added Course (VAC)	10			
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	4			
3	racuity Core (PC)	Ability Enhancement Course (AEC)				
	1	Total	98			

Breakdown by categories of courses

Sl no	Category	Credits	%
1	Science	89	90.82%
2	Engineering	1	1.02%
3	Humanities and Management	8	8.16%
	Total	98	100%

SEMESTER WISE COURSE DISTRIBUTION

	G N	G G 1	G TY	Course]	En	gaş	ger	nei	nt		Maxim	um Ma	rks for	
	S. No.	Course Code	Course Title	Category	L	T	P	S	R	0	C	IA*	SEE*	PE*	Total
	1.	23MSZO111R	Taxonomy and Basic Entomology	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23MSZO112R	Biochemistry and Bioinstrumentation	DSC	3	0	2	0	0	0	4	40	60	100	200
er I	3	23MSZO113R	Genetics	DSC	3	0	2	0	0	0	4	40	60	100	200
st	4	23MSZO114R	Cell Biology	DSC	3	0	2	0	0	0	4	40	60	100	200
Semester	5	23MSZO115R	Mini Research (Review of literature- R1)	Research	0	0	0	4	8	0	2	-	-	100	100
	6	23MSCE111R	MOOCS-I	VAC	0	0	0	0	0	0	2	0	100	-	100
	7	23UMFS111R	Fundamental of Statistics	MDC	2	0	2	0	0	0	3	40	60	100	200
	8	23UMPD111R	Effective English	AEC	0	0	4	0	0	0	2	-	-	100	100
		Tot	tal		14	0	14	4	8	0	25	200	400	700	1400
	G. N	G G 1	C Trial	Course]	En	gaş	gen	nei	ıt		Maxim	um Ma	rks for	
	S. No.	Course Code	Course Title	Category	L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
	1.	23MSZO121R	Endocrinology and Immunology	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23MSZO122R	Molecular Biology, Genomics and Genetic Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23MSZO123R	Evolution and Ecology	DSC	3	0	2	0	0	0	4	40	60	100	200
П	4	23MSZO124R	Apiculture (Techno Professional Skill-I)	SEC	0	0	4	0	0	0	2	0	0	100	100
Semester	5	23MSZO125R	Mini Research (Research gap analysis-R2)	Research	0	0	0	4	16	0	2	-	-	100	100
S	6	23MSCE121R	MOOCS-CE II	VAC	0	0	0	0	0	0	2	0	100	-	100
	7	23MSZO126R	Generic Elective (Coursera)	DSE	2	0	0	0	0	0	2	40	60	-	100
	8	23UMRM121R	Research methodology and Statistical Analysis	MDC	1	0	0	4	0	0	2	40	60	100	200
	9	23UUHV101R	Universal Human Values (UHV) + Professional Ethics	VAC	1	0	2	4	0	0	2	40	60	100	200
	10	23UMPD121R	Communication Mastery	MDC	0	0	4	0	0	0	2	0	0	100	100
		Total			13	0	18	12	16	0	26	240	460	800	1600

	S. No.	Course Code	Course Title	Course]	En	gaş	gen	ner	nt		Maxim	num Ma	rks for	
	5. 110.	Course Code	Course Title	Category	L	T	P	S	R	O	С	IA*	SEE*	PE*	Total
	1.	23MSCE211R	MOOCS-CE III	VAC	0	0	0	0	0	0	2	0	100	-	100
	2	23MSCE212R	MOOCS-CE IV	VAC	0	0	0	0	0	0	2	0	100	-	100
	3	23MSZO211R	Ornamental Fish Farming (Techno Professional Skill-II)	SEC	0	0	4	0	0	0	2	0	0	100	100
r III	4	23MSZO212R	Generic Elective (Coursera)	VAC	0	0	0	0	0	0	2	40	60	-	100
Semester III	5	23MSZO215R	Mini Research (Survey/experiments)- R3	Research	0	0	0	4	16	0	2	-	-	100	100
	6	23UMRE211R	Research Ethics	AEC	1	0	0	0	0	0	1	-	-	100	100
	7	23UMPD211R	Corporate Proficiency	MDC	0	0	4	0	0	0	2	-	-	100	100
	8	23MSZO216R	Animal Physiology	DSE	3	0	2	0	0	0	4	40	60	100	200
	9	23MSZO217R	Developmental Biology	DSE	3	0	2	0	0	0	4	40	60	100	200
	10	23MSZO218R	Aquaculture	DSE	3	0	2	0	0	0	4	40	60	100	200
	11	23MSZO219R	Animal Diversity	DSE	3	0		0	0	0	4	40	60	100	200
		To	tal		13	0	22	4	0	0	29	200	500	700	1500
	SN.	Course Code	Course Title	Course			gaş	_		ıt		Maxim	num Ma	rks for	
	D14.	Course Coue	Course Title	Category	L	T	P	\mathbf{S}	R	O	C	IA*	SEE*	PE*	Total
	1	23MSZO221R	Research/ data analysis/ documentation- R4	Research	0	0	20	8	4	0	12	0	0	100	100
	2	23MSZO222R	Entomology I (Insect biology, Ecology and Pest management)	DSE	2	0	0	0	0	0	2	40	60	0	100
r IV	3	23MSZO223R	Entomology II (Insect Physiology and Toxicology)	DSE	3	0	2	0	0	0	4	40	60	100	200
Semester	4	23MSZO222R	Fish Biology and Fisheries I (Fish physiology and Fish culture)	DSE	2	0	0	0	0	0	2	40	60	0	100
	5	23MSZO223R	Fish Biology and Fisheries II (Fish reproductive biology, endocrinology and fish genetics)	DSE	3	0	2	0	0	0	4	40	60	100	200
	6	23MSZO222R	Molecular Cell Biology I	DSE	2	0	0	0	0	0	2	40	60	0	100
	7	23MSZO223R	Molecular Cell Biology II	DSE	3	0	2	0	0	0	4	40	60	100	200
		To			5	0	22	8	4	0	18	80	120	200	400
	•	Total for a	ll four Semester								98				4900

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

		SEME	STER – I								
Course Tit	le	TAXONOMY			ENTO	MOL	OGY				
Course cod		23MSZO111R Total credits: 4			Т	P	S	R	O/I	7	С
		Total hours: 45	T+30P	3	0	2	0	0	0	\top	4
Pre-requisi	te Nil	Co-requis	ite		1	1	Nil		1		
Programm		MASTER C		CE I	N ZO	OLOG	Y				
Semester		Fall/ I semester	r of first y	ear o	of the p	progra	mme				
Course	1. To impart the k	nowledge of taxo	nomy and	scho	ols of l	oiologi	cal cla	ssifica	ation.		
Objectives	2. To provide the	~	•			_				nt.	
	3. To provide s	skill on insect-	based indu	ıstrie	s for th	ne bene	fit of 1	manki	nd.		
CO1	Discuss the history	and concept of ta	xonomy a	nd its	classi	ficatio	1.				
CO2	Identify various app	proaches of taxon	omy and i	ts imp	portano	ce					
CO3	Describe the collec	tion, identification	n and pres	ervati	ion pro	cess o	fanim	al			
CO4	Identify insect pests	s and vectors resp	onsible fo	r dise	ases.						
CO5	Determine the com	mercial value of i	nsects and	plan	for rea	aring ii	sects.				
Unit-No.	Conte	nt	Contact		Lea	rning	Outco	me		F	ΚL
			Hour						_		
	Definition and basic (Concepts of		Stı	ıdents	will ac	quire				
	taxonomy:				•	ge rega	_				
I	History of classificati	ion and its	7	his	history and concept of					1,2	12
. •	importance	,	tax	taxonomy				,	.,_		
	Aims and objective or										
	Scope of taxonomy										
	Different approaches			Students will be able to apply							
	-	and its importance:			knowledge on application of						
II	Morphological, Embr	10		different approaches to be						1,2	
	Molecular, Ecologica				adopted in taxonomy for different group of organisms						
	Behavioural approach			_							
	Nature and Character Taxonomic procedure					will ga			ge		
	Taxonomic procedure				Differ	,					
	preservation and proc			•		ion pro			1		
	identification of biolo			e or ke entifica	ys for s	species	5				
	Taxonomic keys: Dif						anira				
	taxonomic keys, their demerits	merits and				will ac	_	les an	d		
III	International Code of	Zoological	10		knowledge on Principles and rules of nomenclature			u	1	1,2	
	Nomenclature (ICZN	•	10	commission.				,	.,_		
	principles; History of					.011.					
	Zoological nomencla	ture									
		Interpretation and application of important rules Formation of scientific names of									
	different taxa. Regula										
	this code and code of								_		
	Introduction to Applie					se aims					_
,	Economic importance					with ar			n		
***	(honey bee, silkworm					plicatio	n and				
IV	Insect pests, vectors of	of diseases:	8		onomio portan]	1,2
,	Mosquito, fly				tomolo						
	The role of insects in environmental indicate				. 5.11010	01					

	1		T	
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	 Identification and classification of 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 of sting apparatus in honey bee. 	30		1,2,3,4

- T1: Insect pest management by Dent D R, (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.]

	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

SEMESTER – I										
Course Tit		BIOCHEMISTRY	AND I	SIO	INSTRU	UMEN	TATI	ON		
Course cod	e 23MSZO112R	Total credits: 4		L	Т	P	S	R	O/F	C
		Total hours: 45T	+30P	3	0	2	0	0	0	4
Pre-requisi	te Nil	Co-requisite	1				Nil			
Programm	e	MASTER C	F SCIE	NC	CE IN ZO	OOLO	GY			
Semester		Fall/ I semester								
Course	*	nd the fundamentals			•					
Objectives		s. To develop know	ledge an	d id	lentify th	e chen	nical lo	gic of l	bioener	getics
	and metaboli	•							_	
	_	owledge of principl	les and a	ppli	ications (of anal	ytıcal ı	nstrum	ents in	life
	sciences.	. 1 . 1 . 1	. c.		1 1		. ,.	C D		1
	•	iological samples fo	or purific	atio	on and ci	naracte	erisatio	n of Pro	oteins a	ana
CO1	Nucleic Aci	ncepts of carbohydr	otos lini	do	nuoloio (oids r	itomin	a and n	ninaral	0
CO2		t of Bioenergetics in	_							S.
CO2		ciples and operation							•	
CO3	•	ciples and application								cules
	from biological		on or 60p	us U	on und	J.1.u.1 u.C		JII 01 U	-0111010	20100
CO5		tography technique	s to sepa	rate	e molecu	les.				
	Cont	0 1 0 1	Contac				g Outc	ome		KL
Unit-No.			Hour		20	,	5 o are	01110		
	Concept of biomole	Concept of biomolecules (composition,				will le	earn al	out		
	•	ructure and functions):			oiomolec	ules, tł	neir uni	que		
	 Carbohydrates 	•			structural	charac	cteristic	es and		
	• Lipids			f	unctions					
_	 Nucleic acids 		7							1.2
I	• vitamins and mine	erals.	7							1,2
	• Special focus on c	onformation of								
	proteins (level of p	orotein								
	organization and I	organization and Ramachandran								
	plot), domains, mo	otif and folds.								
	Bioenergetics:				They wil	ll gain l	knowle	dge in		
	• Concept of thermo				Basics of					
		y and free energy)			(Bioener	-				
	• Reaction kinetics				dynamic		-	_		
	phosphorylation a				know ab	out enz	zymes	and the	ir	
	phosphorylation, c	-			kinetics					
	group transfer and	biological energy								
II	transducer).	mass Definition	10							1,2
11	Enzymology/Enzy and structural orga		10							1,2
	-	tion, mechanism of								
	•	d factors affecting								
	enzyme activity. S	-								
	active site.									
	• Enzyme regulatio	n and role of								
	inhibitors.									

	Metabolism of biomolecules:		They will be gaining knowledge	
	Carbohydrate metabolism-Glycolysis		about carbohydrate metabolism.	
	and its regulation, Gluconeogenesis,		Also, they will get to know	
	Glycogenolysis TCA cycle, Pentose		lipid, protein and nucleic acid	
	phosphate pathway		metabolism.	
	Lipid metabolism: oxidation of fatty		metabolism.	
	acid and biosynthesis of fatty			
	synthesis. Heme synthesis and			
III	degradation.	10		1,2
	Amino acid metabolism-			
	Transamination, deamination and			
	urea cycle.			
	Nucleotide metabolism -			
	Biosynthesis of purines and			
	pyrimidines by de novo and salvage			
	pathways, inhibitors of nucleotide			
	synthesis, degradation of purines			
	and pyrimidines.			
	Gel Electrophoresis:		Students will understand the	
	• Introduction, principle, types,		Techniques to measure, study	
	application.		And observe Biomolecules like	
	PCR: Introduction, types and		Proteins, DNA,RNA etc.	
	application.			
	Blotting technique: Southern blot,		Students will learn Microscopic	
	Western Blot and Northern blot,		technique applied to understand	
	Microscopy:		cellular ultrastructure and	
	• Introduction, types (light field		function of genes and proteins.	
	microscope, dark field microscope,		Students will apply the	
	phase contrast microscope,		knowledge of radioactive tracer	
IV	fluorescence microscope, AFM and	8	molecule to track down	1,2
	Electron microscope), and		biochemical metabolism and	
	application.		gene expression	
	Centrifugation:			
	• Introduction, principle, types of			
	centrifuge and rotors, application of			
	density gradient and analytical			
	centrifugation			
	Radioactive tracer technology:			
	Principle, measurement and			
	applications in biology			
	Chromatography:		Students will learn the principle	
	Introduction, Principle,		and applications of	
	Classification, Column		Chromatography in protein	
	Chromatography; Adsorption column		purification, MW determination	
V	chromatography; operational	10	Students will understand the	1,2
	technique, elution procedure,	-	principle and application of	, -
	application, Partition		Spectroscopic technique to	
	chromatography. Thin layer		Gauge conformation and	
	chromatography: Introduction,		Concentration of biomolecules	
	Principle, technique, application and			

	HPTLC. Rf value. Gas Chromatography 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.		Students will be able to separate biomolecules from complex mixtures.	
Practical	 Estimation of protein by Lowry's/ Bradford method. Estimation of Glucose by Anthrone method. Estimation of RNA/ DNA. Achromic point of salivary amylase Qualitative analysis of protein, carbohydrate and amino acid 	30		1,2,3,4

- 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

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					

			SE	MESTER – I							
Course Tit	le			GENE'	TICS	_					
Course cod	de	23MSZO113R	Total credi	ts: 4	L	T	P	S	R	O/F	C
			Total hours	s: 45T+30P	3	0	2	0	0	0	4
Pre-requis	ite	Nil	Co-re	equisite				Nil			
Programm	ıe		MASTE	ER OF SCIEN	ICE I	N ZO	OLOG	Y			
Semester		Fall/ I semester of first year of the programme									
Course		1. To introduce learner to the science of heredity, from its basic principles to the most									
Objectives		recent advances									
		2. To impart know		etic alterations	in hu	man g	enome	e, class	sical a	nd	
		molecular gener									
001		3. To impart knowl									
CO1		Describe chromati								D.	1 '1
CO2		Explain mechanism			-	_				-	oniia,
CO3		and C. Elegans, di									ne in
003		Apply karyotypin genetic disorders,								_	
		contexts.	use logarithi	ii oi tiic odds s	cores	101 1111	Kage t	csung	m spc	ciric di	scasc
CO4			c inheritance	e heritability t	hroug	h Oua	ntitativ	ve Tra	it Loc	us man	ning
		Evaluate polygenic inheritance, heritability through Quantitative Trait Locus mapping, linkage maps, and tetrad analysis, explain Human Genome Project and Mapping.									
CO5		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.									
					our Learning Outcome						
Unit-No.		Content		Contact Ho	ur	I	Learni	ing O	ıtcom	e	KL
Unit-No.	Ch	Content romosome: Eukaryo	otic	Contact Ho	our	I Learn					KL
Unit-No.				Contact Ho	our		ers wo	ould be	able	to	KL
Unit-No.	stru	romosome: Eukaryoucture of chromatin romosome, heteroch	and	Contact Ho	our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	KL
Unit-No.	stru chr euc	romosome: Eukaryoucture of chromatin comosome, heterochehromatin	and nromatin,	Contact Ho	our	Learn Under	ers wo stand omatii	ould be basic	able conce	to	KL
Unit-No.	stru chr euc Ex	romosome: Eukaryoucture of chromatin romosome, heterochehromatin tension of Mendel's	and nromatin,	Contact Ho	our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	KL
	stru chr euc Ex-	romosome: Eukaryoucture of chromatin comosome, heterochehromatin tension of Mendel's nciples: Codominar	and nromatin,		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
Unit-No.	stru chr euc Ex pri inc	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance	and aromatin, since, gene	Contact Ho	our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	KL 1,2
	struchi euc Ex pri inc	romosome: Eukaryoucture of chromatin comosome, heterochehromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance	and aromatin, since, e, gene ee and		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
	struchi euc Ex prii inc inte	romosome: Eukaryoucture of chromatin comosome, heterochehromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrancoressivity, epistasis,	and aromatin, since, e, gene se and		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
	struchi euc Exi prii inc inte exp	romosome: Eukaryo ucture of chromatin comosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, niotropy, genomic in	and nromatin, s nce, e, gene ee and nprinting,		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
	struchine expenses of the control of	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, ciotropy, genomic in kage and crossing o	and aromatin, since, e, gene ee and apprinting, ever, sex		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
	struchi euc Ext pri inc inte exp ple lind	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, niotropy, genomic in kage and crossing of kage, sex limited an	and aromatin, since, e, gene ee and apprinting, ever, sex		our	Learn Under of chr	ers wo stand omatii	ould be basic	able conce	to	
	chm euce Ex prii ince inte exp ple lind lind inf	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, ciotropy, genomic in kage and crossing o	and aromatin, since, e, gene ee and apprinting, ever, sex		our	Learn Under of chr intera	ers wo stand omatii	buld be basic and g	e able conce gene	to pts	
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I	structure chine euco Ex prii inco into exp ple lind lind inf Med det Co Dro Str	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, ciotropy, genomic in kage and crossing o kage, sex limited an luenced characters. echanisms of sex termination and Dos mpensation: Human osophila and C. eleg	and aromatin, s ace, e, gene ee and apprinting, ever, sex ad sex sage an, gans cal	7	our	The leasure determined able to struction	earners of the ninatio phila. Odistir	s will be sex on in h	e able conce gene pecom uman lalso la between the concerning to th	e and be	1,2
I	struchine euco Ex prii ince inte exp ple lind lind inf Med det Co Drec Struch De	romosome: Eukaryo ucture of chromatin romosome, heteroche chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, ciotropy, genomic in kage and crossing o kage, sex limited an luenced characters. echanisms of sex remination and Dos mpensation: Human osophila and C. eleg uctural and numeric errations of chromos letion, duplication,	and aromatin, ance, ance and anprinting, ance, ance and ance, ance ance ance ance ance ance ance ance	7	our	The leasure determined aberra	earners of the ninatio phila. of distir	s will be sex on in had numof chroof chro	e able conce gene gene with also between the comoso	e and be sen	1,2
I	struchine euco Ex prii ince inte exp ple lind lind inf Med det Co Drec Struch De	romosome: Eukaryo ucture of chromatin romosome, heteroch chromatin tension of Mendel's nciples: Codominar complete dominance eractions, penetrance pressivity, epistasis, ciotropy, genomic in kage and crossing o kage, sex limited an luenced characters. echanisms of sex termination and Dos mpensation: Human osophila and C. eleg uctural and numeric errations of chromose	and aromatin, ance, ance and anprinting, ance, ance and ance, ance ance ance ance ance ance ance ance	7	our	The leasure determined able to struction	earners of the ninatio phila. Odistir ural an ations oarn the	s will be sex on in had numof chroof chro	e able conce gene gene with also between the comoso	e and be sen	1,2

III	Human Genetics: Karyotypes, pedigree analysis, LOD score for linkage testing, Chronic myeloid leukaemia, Burkett's lymphoma and retinoblastoma.	10	Learners will be able to understand inherited genetics and diseases associated to gene alteration	1,2
IV	Quantitative inheritance: Polygenic inheritance, heritability, QTL mapping. Gene mapping methods: Linkage maps, tetrad analysis, Basic idea of Human Genome Project and Mapping.	8	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	 Study of divisional stages in Mitosis using onion root tip. Study of divisional stages in Meiosis using permanent slides of grasshopper's testes. Preparation and mapping of polyethene chromosomes from salivary gland of Chironomus/Drosophila larvae. Preparation of human karyotypes: normal male and female: analysis of common human chromosomal aberrations from the pictures provided. To solve some genetic problems based on pedigree analysis. To solve some genetic problems based on gene interaction. 	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.]

	CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome						
1	Describe chromatin, chromosomes, heterochromatin and	1, 3						
	euchromatin.							
2	Explain mechanisms of sex determination, dosage	1, 3						
	compensation in human, Drosophila, and C. Elegans, discuss							
	on structural and numerical aberrations of chromosomes.							
3	Apply karyotyping and pedigree method for identification of	1, 3, 8						
	inheritance patterns in genetic disorders, use logarithm of the							
	odds scores for linkage testing in specific disease contexts.							
4	Evaluate polygenic inheritance, heritability through	1, 3, 8						
	Quantitative Trait Locus mapping, linkage maps, and tetrad							
	analysis, explain Human Genome Project and Mapping.							
5	Discuss lac and tryptophan operon concept of gene regulation,	1, 3						
	in prokaryotes, gene regulation in eukaryotes, explain							
	restrictive enzymes and their role in recombinant DNA							
	techniques.							

		SEMESTER -	- I									
Course Tit	le	CELL 1	BIOLO	GY								
Course coo	de 23MSZO114R	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				Nil						
Programm	ne	MASTER OF SCI	ENCE I	ΝZ	COOLO	GY						
Semester		Fall/ I semester of firs	st year o	f th	e progr	amme						
Course	1) To make stud	1) To make students understand the structures and purposes of basic components of										
Objectives	• •	prokaryotic and eukaryotic cells, especially macromolecules, membranes, and										
	organelles											
		v the cellular components a						ergy in	cells.			
001		e cellular components und		nito	tic cell o	divisio	n.					
CO1		ne structure and its function										
CO2		ral organization of cell and	their ro	les.								
CO3		nt cell cycle processes.	• .•									
CO4		sm of cell-to-cell commun			.1 .		<u> </u>					
CO5		ns of cells and resulting di	Seases b Contac						-			
Unit-No.	C	Content				rning	Outco	me	KL			
	Mambana Staniatura	and Function: (Structure	Hour		Vnovilo	daa of	atmiati	ma of				
	of a model membran	,			Knowle	-		ure or				
					cell membrane and							
I	_	embrane protein diffusion, osmosis, ion nannels, active transport, membrane pumps,				function						
1	mechanism of sorting		7				1,2					
		-										
	membranes)	tracellular transport, electrical properties of embranes)										
		tructural organization and function of				To learn the basic						
	_	es (Cell wall, nucleus,				ļ						
	mitochondria, golgi b				structural organisation of intracellular							
II		m, peroxisomes, plastids,	10		organel	1,2						
	*	t, structure and function										
	of cytoskeleton and i											
		Cell Cycle (Mitosis and			To understand the basic							
III		tion, steps in cell cycle,	10		how a cell divides and its 1,							
	regulation and contro	ol of cell cycle)			importa	nce in	cell cy	cle				
	Cell signaling: (Ligar	nds and their receptors,			To know	w abou	t the					
	cell surface receptor,	signaling through G-			commu	nicatio	ns and					
	protein coupled recep	otors, signal transduction			signalli	ng med	hanisn	ns in				
IV	pathways, second me	essengers, regulation of	8		cells				1.2			
1 V	signaling pathways, l	bacterial and plant two-	o						1,2			
	component systems,	omponent systems, light signaling pathways a plants, bacterial chemotaxis and quorum										
	in plants, bacterial ch											
		ensing) neurotransmission and its regulation										
	Cellular communicat	_			Knowle	-						
	hematopoiesis, gener	• •		Basic regulatory								
V		adhesion and roles of	10		mechanisms of cell							
•	different adhesion me	10		commu	nicatio	ns		1,2				
	extracellular matrix,	integrins)										

Practical	 Microscopic observation and comparison between prokaryotic and eukaryotic cell. Isolation of mitochondria and staining. Counting of RBC and WBC in human blood. Extraction of membrane lipids and observation of lipid bilayer formation. Squash preparation. sub-cellular fractionation - separation of macromolecules. 	30		1,2, 3,4	
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- 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

CO PO Mapping						
SN	Course Outcome (CO)	Mapped Program				
511		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	1 2				
3	their improper functioning.	1,3				

				SEMEST	ER – I									
Cours	se Title	MI	NI RESI	EARCH (R	REVIEW (OF :	LITE	ERA'	TU	RE-	R1)			
Cours	se code	23MSZO115R	Total cr	edits: 2		L	T	P		S	R	O/F	C	
			Total ho	ours: 60P		0	0	0		4	8	0	2	
Pre-re	equisite	Nil	(Co-requisite Nil						l				
Progr	amme		MAS	STER OF	SCIENCE	E IN	ZO	OLO)G	Y				
Semes	ster		Fall/ I s	semester of	f first year	r of	the p	rog	ran	nme				
Cours	se	1. To make Stude	ents fami	liar with ar	nd learn to	o ide	entify	the	mo	ost re	eleva	nt text	tbooks,	
Objec	etives	reviews, papers ar	nd journa	ls for their	research to	opic	s.							
		2. To impart kno	wledge (on how to	critically	rea	d and	d ass	ses	s res	earcl	n pape	ers and	
		reviews.												
		3. To make studer	nts famili	ar with the	formulation	on o	f rese	earch	w	ork i	n pro	per sc	ientific	
		manner.												
(C O 1	Use of database a	Use of database and libraries for original research, books and other article.											
C	CO2	Summarize differ	Summarize different types of reviews in the form of analytical and descriptive review.											
C	CO3	Identify relevant topic for continuing research and methods of collection including												
		filtering of inform	nation.											
C	CO4	Analyse the demo	onstration	ns and find	ings made	e by	prev	ious	au	thors	and	comp	rehend	
		them.												
C	CO5	Write a review ex	plaining	the prospec	cts of study	y ch	osen.							
Unit-	1	Content		Contact		Le	arnir	ng O	uto	come	•		KL	
No.				Hour										
	Introdu	iction, comprehens	ion on		Describe	e, ill	ustrat	te an	d e	xpla	in cel	1		
I		h search engines, s	election	15	organiza								1,2	
	of topi				microsco							ces.		
	Tools f	Describe					_							
II		nt methods for writ	ing	10		mbrane structure, function; cell						1,2		
	citation	and references.			organiza			the p	rot	teins	invo	lved	1,2	
					in transp									
		ection to structure of			Describe					_				
III		and specific featur	res of	15	chromos	soma	al stru	ıctur	e a	nd ty	pes.		1,2	
review														
	Plagian	rism, ethical issues	in		Describe	- illi	listrat	te an	d e	xnla	in the	7		
IV	_	the review	111	10		be, illustrate and explain the nism of cell-to-cell						1,2		
1	WIIIII	, the leview			communication							1,2		
	Manni	ng and selection of	iournal	Describe, illustrate and explain the							e cell			
		•	J =	cycle and division in general and in										
1	of spec	ific knowledge of			cycle and	d dr	V1S1Ot	1 1n 🤉	gen	ierai	ana 1	n	1,2	
V	_	rific knowledge of ine and submission	for	10	some spe			-	-	ierai	ana 1	n	1,2	

- 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					

	SEMESTER – I												
Course Title		FUNDAM	IENTAL	OF S'	TATIS	STICS							
Course code	23UMFS111R To	tal credits: 3		L	T	P	S	R	O/F	C			
	To	tal hours: 30	T+30P	2	0	2	0	0	0	3			
Pre-requisite	e Nil	Co-requis	ite		•		Nil						
Programme		MASTER C	F SCIEN	ICE I	N ZO	OLOG	Y						
Semester	F	all/ I semeste	r of first y	year o	f the p	rogra	mme						
Course	1. Help to understand	the role of stat	istics in da	ata ana	alysis,	decisio	n-mal	cing, a	nd scie	ntific			
Objectives	research												
	2. Introduce students	-			_					-			
	(mean, median, mod		_		_								
	3. Teach students how	to summarize	and preso	ent da	ta effe	ctively	using	tables	, charts	, and			
001	graphs					2 1							
CO1	Describe statistical po	_	ample, co	mpile,	, classi	ty and	charac	terize	data				
602	including scale of mea			1 .	1. ! .	-1 C	1 .	1 - '	. 41				
CO2	Compile and present udescriptive statistics.	inivariate data	in tabulai	r and g	grapnic	ai iorn	i and e	expiaii	i the				
CO3	Compile and present b	riveriete dete e	and avaloi	n it br	, vorio	na hivo	rioto o	nolvoj	a inclu	dina			
CO3	the predictions/ foreca		iiiu expiai	ппоу	vario	us biva	mate a	marysi	s, meru	unig			
CO4	Compute probability i	•	ts and dis	tributi	ons (ne	ormal	hinom	ial Po	isson)				
CO5	Explain the methods of									em to			
	evaluate specific cases		osting, pur	umou	ie uiiu	non pu		ie und	ase the	2111 10			
Unit-No.	Content		Contact	t	Lea	rning	Outco	me		KL			
			Hour			O							
	Statistical Methods: Def	inition and		De	scribe,	illustra	ate and	l expla	in				
	scope of Statistics, conc	epts of		cel	l organ	izatior	and						
	statistical population and	d sample.		fun	ctions	, micro	scopy	and					
I	Data: quantitative and q	ualitative,	5	strı	ıctural	differe	ences.		1,2				
	attributes, variables, sca												
	measurement nominal, o	ordinal,											
	interval and ratio.												
	Presentation: tabular an					illustra		_					
	including histogram and	· ·		membrane structure, function; cell organization and the									
	Measures of Central Te	-			_			he					
II	mathematical and positi		5	_		nvolve	d in			1,2			
	Measures of Dispersion	-		trai	nsporta	ition.							
	quartile deviation, mear standard deviation, coef												
	variation, skewness and												
	Bivariate data: Definition			De	scribe	illustra	ate and	lexpla	nin				
	diagram, simple, partial					mal sti		_	****				
	correlation (3 variables	_	_	typ						_			
III	correlation. Simple line	- ·	5	3,1					1	,2,3			
	fitting of polynomials a	_											
	exponential curves.												
	r		l										

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

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	

CO PO Mapping							
SN	Course Outcome (CO)	Mapped Program Outcome					
1	Describe statistical population and sample, compile, classify and characterize data including scale of measurement.	1, 2					
2	Compile and present univariate data in tabular and graphical form and explain the descriptive statistics.	1, 2, 3					
3	Compile and present bivariate data and explain it by various bivariate analysis, including the predictions/ forecasting.	1, 2					
4	Compute probability including events and distributions (normal, binomial, Poisson).	1, 2					
5	Explain the methods of hypothesis testing, parametric and non-parametric and use them to evaluate specific cases.	1, 2, 3, 8					

		SEMESTE	ER – I						
Course Ti	tle EFFECTIVE	ENGLISH (COMM	IUNICAT	IVE E	ENGL	ISH (& SOI	T SKIL	LS)
Course co	de 23UMPD111R	Total credits: 4	L	T	P	S	R	O/F	C
		Total hours: 60P	0	0	4	0	0	0	2
Pre-requi		Co-requisite					[il		
Programn	ne	MASTER OF S							
Semester		Fall/ I semester of	first year	of the	prog	ramı	ne		
Course		he types of sentences a	and their sig	nifican	ice.				
Objective		the students' vocabular			_	_		_	
	3. To familiarize the students with the importance of dress codes in various organizations								
CO1		nable students to analys							
CO2		able to integrate the sl	kills of rea	ding a	nd spe	eaking	g in pro	ofessional	
	communication.								
CO3	•	tte sessions will boost t							
CO4		about the effective and							
CO5		onetics and its importar	nce will imp	prove tl	he leai	rners'	pronur	ciation	
Unit-N	o. Co	Content			Lear	rning	Outco	ome	KL
			Hour						
	Grammar	Interchange of Interrogative and sertive Sentences, Exclamatory and sertive Sentences Types of Tenses Common Errors Synonyms			Identify and understand the				
	_				structure of interrogative and assertive sentences. Transform and enhance				
_					grammatical accuracy and sentence formation skills.				
I	. –								
	v. Antonyms vi. Homonyms								
	- Reading Skills			Dev	elon	ctrate	gies f	or facter	
	_	Cechniques of Effective Reading			Develop strategies for faste reading with bette				
	ii. Gathering ideas and			comprehension and improv					
II	a text The SQ3R Tech		the ability to recall				•	1,2	
	text	andae merbier and		orga	nize	textu	al inf	ormation	
					emati	cally.			
	Listening Skills			Und	erstar	nd th	e fun	damental	+
	i. What is listening?							ance of	
	ii. The Process of Lis	tening						helps to	
	iii. Factors that advers	-		enha	ance	inter	persoi	nal and	
Ш		Difference between Listening and						unication	1,2
	Hearing,	5	10	by p	ractic	ing li	stenin	g skills.	
	v. Purpose and Impor	rtance of Effective							
	Listening								
1	1	istening Process							1

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	1							
1	types of sentences.	1							
2	Learners will be able to integrate the skills of reading and	1, 2							
	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	1 8							
	learners' pronunciation	1,8							

	SEMESTER – II										
Course Ti			ENDOCRINOLOG						,		
Course co	ode	23MSZO121R	Total credits: 4	L	T P		R	O/F	C		
			Total hours: 45T+30I	2 3	0 2		0	0	4		
Pre-requi		Nil	Co-requisite			N					
Programm	ne		MASTER OF SO								
Semester			Fall/ I semester of f								
Course			nd the nature, function		•			_			
Objective	S		s and its connections to				e glano	ds, hypo	physis,		
			thyroid, adrenal, pancrea						_		
			es students with inverteb	rate endoci	rine syst	ems for	applic	ation in	various		
		fields like pe				.1 11	cc .		6 .1		
			dents about immunolog	•				-			
		•	tem including types of	cells inv	olved, a	acquire	ı, ınna	ite imm	unities,		
CO1			and immunoglobulins. s endocrine glands an	d their fo	notions	includ	ing hi	ocunthoo	ic and		
COI		classification of	_	u uicii 10	neuons	merua	mg oi	osynthes	is allu		
CO2			rine, hypothalamus and t	heir functi	ons incl	uding i	nvertel	rate hor	mones		
CO ₃			* *					rate nor	mones.		
CO4		Explain the types of immunity including functions of immune cells. Describe immunogens, properties, structure and functions including factors affecting									
		antigenicity.	nogens, properties, stra	cture una	ranction	is incru	umg n	actors ar	reeting		
CO5		Identify various immunoglobulins, their processing, presenting, activation and									
		differentiation.									
Unit-		Co	ntent	Contact	Le	arning	ning Outcome				
No.				Hour							
	End	ocrine glands, the	ir hormones and		To ga	in basic	know	ledge			
I	class	sification; Biosyn	thesis, storage and	7	and understanding of			1,2			
•	mec	hanism of action	of protein and steroid	,	endoc	rine gla	nds an	d	1,2		
		nones.			hormo						
		ocrine hypothala	amus			derstan					
		tuitary, Thyroid,			_	ifferent	-				
		rathyroid,				neir sec					
II		ncreas,		10	_	te and			1,2		
			ructure, secretions and			olism, g					
		nctions of each g	land. nes and their functions.			functio	ns of tr	ie			
	body.			_							
		es of immunity:				stand tl		-			
			d immunity; passive and			n of imi	-				
		tive immunity;	11 . 12			helps in	-	_			
III			nediated immunity.	10		gens and			1,2		
		~	system: Primary and		то кее	p the bo	ouy nea	aiuiy			
		condary lymphoi	-								
			nmune cells: types and								
	pr	oduction.		1							

	Immunogens (Antigens)		To understand and analyse			
IV	General properties, Structure and function,		the knowledge gained on			
	Factors affecting antigenicity		nature of immunogens.			
IV	Epitopes and Haptens	8	How vaccines are produced	1,2		
	Adjuvants		by knowing the			
	Taja tano		antigenicity factors			
	Immunoglobulins (antibodies)		To understand the			
	General Properties- Structure and		importance of antibodies in			
X 7	functions		immune response, the			
	Different classes of immunoglobulins		functions of major immune			
	(IgA, IgD, IgE, IgG and IgM)	10	cells and how the	1.2		
V	Antigen-antibody interactions: Primary	10	activation of these cells is	1,2		
	and secondary immune responsesMajor Histocompatibility Complex		done.			
	(MHC), antigen processing and presentation, activation and differentiation		Studying about how	1		
			scientist created vaccine			
	of B and T 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,		
Tractical	• Study of different types of cells in the	30		4		
	blood 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: https://www.classcentral.com/course/swayam-endocrinology-19855
- 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	1
	including 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,	1, 2
	presenting, activation and differentiation.	

		SEMESTER -	- II						
Course Tit	tle MOLECULA	AR BIOLOGY, GENO	MICS AN	D GEN	ETI	C EN	IGIN	NEER	ING
Course co	de 23MSZO122R	Total credits: 4]	Γ	P	S	R	O/F	C
		Total hours: 45T+30P	'	3 0	2	0	0	0	4
Pre-requis	ite Nil	Co-requisite				N	il		
Programm	ne	MASTER OF SCI	ENCE IN	ZOOI	LOG	Y			
Semester		Fall/ I semester of first							
Course		pth about genome and its	•		•				
Objectives	transcriptional (explanation/poattention.	entral dogma of life (replications) with the lower point presentation/s	best possil seminar/as	ole teach	hing t nt) ar	tools nd wi	th ut	_	oost
CO1		cs, genome, proteome and							
CO2		ral dogma including geno							
CO3	Illustrate genome	e sequencing, chromoson	ne paintin	g and g	enom	e ma	ppin	g.	
CO4	Explain DNA m	utation and repair mecha	nisms.						
CO5	Describe genetic	engineering.							
Unit-No.	Co	ontent	Contact	Lea	arnin	g Oı	ıtcor	ne	KL
			Hour						
I	Introduction to genor genome, proteome an		7 Introductory knowledge and refreshing the existing understanding			ing	1,2		
п	The central dogma: translation, replication transcriptional modification binding proteins in general nucleosome modification expression, histone racetylation	on, post- fication role of DNA genome expression, ations and genome	10	in de	etail fo	ollow	ed b	`	1,2
III	Mapping of genomes sequencing, shotgun Euchromatin and het chromosome paintin	sequencing, terochromatin,	10	an in	lain w nporta ome se	ant a	id to		1,2
IV	Accessing the genon painting, nucleosome and genome express chromosome paintin modifications and genome modification Mutations and DNA	e modifications ion, histone, g, nucleosome enome expression, on, acetylation,	8	Genome organisation is discussed in detail with various post translational events along with regulatory mechanisms			il	1,2	
V	Introduction to gene Different DNA man methods for isolating bacteria, plant and a vectors, DNA librari genetic engineering	tic engineering, ipulating enzymes, g DNA, vectors for nimals, expression	Knowledge on D manipulation usi recombinant DN technology			sing	ing		

Practical	 Isolation of genomic DNA. Isolation of plasmid DNA. Polymerase chain reaction. Endonuclease digestion of DNA and analysis of DNA fragments by agarose electrophoresis. 	30		1,2,3,4	
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- 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	itle		EVOLUTION A	AND I	ECOL	OGY					
Course co	de	23MSZO123R	Total credits: 4	L	T	P	S	R	O/F	С	
			Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-requi	site	Nil	Co-requisite				Nil		l .		
Programm	ne	MASTER OF SCIENCE IN ZOOLOGY									
Semester			Fall/ I semester of first year of the programme								
Course		. To sensitize the candidates with various aspects on evolutionary biology, various									
Objective	S	theories related to evolution, patterns of behaviour and biological communications.									
		2. To provide bas	sic and advanced information	on on p	opula	ation and	comm	unity e	cology	7	
		and the immer	sely fascinating world of b	iodive	rsity a	and wildl	ife.				
		3. To give advan	ced information on conserv	ation l	oiolog	y.					
CO1		Explain the theories of evolution.									
CO2		Describe populat	ion genetics and phenomen	on, me	echani	ism, laws	s associ	ated w	ith it.		
CO3		Explain population	on and community ecology.								
CO4		Discuss the work	ing mechanisms of an ecos	ystem.							
CO5			rsity, conservation and mar	•		cluding c	ase stu	dies of	Indiar	1	
		origin	•	C		C					
Unit-		_	ontent	Con	tact	Learn	ing Ou	tcome	K	L	
No.				Но	ur						
	Dar	winism				Student	ts will				
		oncepts of variation,				underst	and the	;			
		-	e, fitness and natural			theories	s of evo	olution			
		election									
I	Mei	ndelism			7				1	,2	
	• S1	pontaneity of mutations								,	
	_	The evolutionary synthesis.									
		oncepts of neutral evolution, molecular									
		vergence and mol									
	-	oulation genetics				Student	ts will a	acauire			
		opulations				knowle					
	• G	ene pool, Gene fro	equency			populat	0	netics			
	• H	ardy-Weinberg La	nw			and var	_				
		oncepts and rate o	0 0			behavio		wn by			
		equency through				organis		•			
		ligration and rand	om genetic drift								
		daptive radiation	ns Speciation, Allopatricity								
		orating mechanish of Sympatricity	ns speciation, Anopatricity								
II		onvergent evolution	on	1	0				1	,2	
		exual selection		_	v					,2	
	• C	o-evolution									
			ion- Group selection								
		in selection									
		eciprocal altruism									
		iological clocks									
		evelopment of belocial communication									
		ocial communicati ocial dominance	OII								
			ritoriolity								
	• 0	se of space and ter	тнопашу								

III	 Population ecology Characteristics and size of a population Growth curves and regulation of Population r and K selection Community ecology Nature of communities Structure and attributes of communities Edge effect and ecotones. Ecological succession (causes and examples) Stability and Climax community Predation Model of prey predator dynamics Predators and their role in nature 	10	Students will gain knowledge on population and community ecology and ecological developmental processes	1,2
IV	 Ecosystem Ecology Ecosystem structure and ecosystem function Energy flow Mineral cycling (C, N, P) Primary production and decomposition Structure and function of some Indian ecosystems, terrestrial (forest) and aquatic (fresh water, marine) 	8	Students will gain knowledge about the structures and function of ecosystem	1,2
V	 Conservation Biology Major drivers of biodiversity change Principles of conservation Major approaches to management Indian case studies on conservation/ management strategy (Project Tiger, Biosphere reserves) 	10	Students will gain knowledge on various conservation strategies and process adopted of conservation of biodiversity	1,2
Practical	 Web based tools for sequence searches and homology screening. Prediction and validation of protein structure using homology modelling. Introduction to bioinformatics: FASTA, BLAST databases. Analysis of water samples for various physico-chemical parameters-pH, free CO2, dissolved oxygen, hardness. Estimation of primary productivity using dark and light bottles. Quantitative estimation of planktons. Assessment of invertebrate and vertebrate diversity in your locality (e.g. campus). Visit to National parks, Wildlife sanctuaries and biosphere reserves of India. 	30		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						

	SEMESTER – II														
Course	Title	AP	ICULTURE (1	TECHNO I	PROF	ESSI	ONAL	SKII	LL - I)						
Course	code	23MSZO124R	Total credits:		L	T	P	S	R	O/F	C				
			Total hours:	60P	0	0	4	0	0	0	2				
Pre-rec	quisite	-													
Progra	mme	MASTER OF SCIENCE IN ZOOLOGY													
Semest	er	Fall/ I semester of first year of the programme													
Course		1. To Understand the historical evolution of apiculture, identify honeybee species, and													
Object	ives	demonstrate the use of different equipment for effective bee rearing and colony management.To Develop and implement seasonal management strategies for honeybee colonies,													
		3. To Identify an		on diseases	s and e	nemie	es of h	oneyb	ees, an		00				
C	01	Explain historica	ffective techniq												
	01	different equipme		_	identi	ry spe	cies c	1 11011	eybee:	s, and t	use of				
CO)2	Demonstrate bee			s mair	tainir	o ania	rv rec	ords						
CO		Analyse and impl		-				· •		onies.					
CO		Plan honey produ									ı.				
CO		Identify enemies							J 1						
Unit-		Content		Contact		Lea	arning	Outo	ome		KL				
No.				Hour				,							
	• Introd	luction to apicultur	re: importance		Stude	ents w	ill be a	able to	expla	in the					
	and his	tory		impo											
I	• Diff	erent species of ho	15			identi			ga rib a	1,2					
	• Bee	keeping equipmen		species of honey bees, and describe the essential equipment used in											
						eeping									
		ling of a honey bee			Students will be able to demonstrate the proper handling of a honey be										
		nance of apiary rec			_	_		-		•	1,2				
II		ction and preservat	tion of bee	15		-				apiary ct and					
	pasture	;						•		apport					
					_		beeke								
	• Seaso	onal management o	f honey bee							y bee					
	colonie	-	Thomey bee					_		erform					
		ellaneous managen	nent	40				-	_	queen					
III		ng, uniting, queen		10	mana	igeme	nt, fee	ding,	shiftin	g, and	1,2				
		mentary feeding, sl	-		addre	essing	robbii	ng or a	bscon	ding.					
		es, robbing, abscon	-												
	• Mani	pulations for honey	y production		Stude	ents	will	optin	nize	honey					
	• Econo	omics of beekeepir	ng		produ	uction	, ι	ınders	tand	the					
IV	• Quee	n rearing		10											
		(a surremmb					_	s for	succ	essful					
				queen rearing.											
		liarization with ene		Students will identify common											
\mathbf{V}		bees and their cont		10	enemies and diseases of honey bees and implement effective control										
		liarization with dis				_				ontrol	1,2				
	or hone	ey bees and their co	ontrol		meas	ures t	o prote	ci col	omes.						

- 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.	1, 6, 8						
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						

			SEMESTE	R – II											
Course Tit	le MI	NI-RESE	ARCH (RE	SEARCH	[GA]	P ANA	LYS	IS - R	R2)						
Course cod	le 23MSZO125R	Total c	redits: 2		L	T	P	S	R	O/F	C				
		Total h	ours: 60P		0	0	4	0	0	0	2				
Pre-requisi	te Nil		Co-requisit	te			•	Nil	•	•					
Programm	e	MASTER OF SCIENCE IN ZOOLOGY													
Semester		Fall/ I	semester of	first year	of th	e prog	ramn	1e							
Course	To determine whe	ther the o	bjectives of	review of 1	litera	ture ga	ap ana	lysis l	have b	een m	et, if				
Objectives	not what steps car	be taken	accordingly	•											
CO1	CO1 Create and implement a plan to bridge the gap														
CO2 Find the gap and evaluate solutions.															
CO3	Identify the ideal	future stat	te/action plan	1											
CO4	To analyse the cur	rrent state	/work of res	earch											
CO5 To implement the strategies to meet the research gap under supervision.															
Unit-No.	Content		Contact		Lea	rning	Outco	me]	KL				
			Hour												
	What is literature re-	view.		Identify 1		•	•			e					
I					uses of language in literary text							S.		1,2	
•					eir texts to particular						1,2				
				audiences											
II	How to Begin the lite	erature	10	Adapt the		•		lar			1,2				
	Review		10	audiences							1,2				
	How to write main b	ody of		The stude											
III	literature review		10	importan			al cons	idera	tion in	1	1,2				
				research											
	How to write conclus	ion		The stude						-					
IV	of literature Review		15	of the ma	-		_		ariabl	es	1,2				
				from the				_							
•	How to analyze gap		40	The students will get practical exposure in writing research papers in proper							1.0				
V	in literature review.		10		_			rs in	prop	er	1,2				
				APA for	mat a	nd sty	les.								

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											
Course '	Title	RESEAR	CH METHODOLOGY	AND S	TA	FIST I	ICAI	AN	ALY	SIS		
Course	code	23UMRM121R	Total credits: 2		L	T	P	S	R	O/F	C	
			Total hours: 15T + 60	S	1	0	0	4	0	0	2	
Pre-requ		Nil	Co-requisite					Ni	il			
Progran		MASTER OF SCIENCE IN ZOOLOGY										
Semeste	r		Fall/ I semester of firs									
Course		1. The course aims to enhances the students' a broad understanding of research										
Objectiv	ves		methodology, including theory of science and qualitative and quantitative methods in									
		research.										
			s to enhance the students							_		
		_	h literature review in dif				_				/a .c. ·	
		_	or preparation of a resear	rch propo	osal	for a	maste	er' th	esis j	oroject/	Mini	
		research.	lanta a anon atan arrin mlam			.4:	1.	4:			4:	
			lents competency in plan	ining, co	nauc	cung,	evan	ıaumş	g and	presen	ung a	
CO	. <u></u>	research project	methodology, evaluate s	ianifiaar	200 (of roc	aarak	and	idor	tify ro	coorah	
	1	_	memodology, evaluate s	igiiiiicai	ice (or res	earci	anu	idei	illiy 16	search	
CO	2	•	problems. Evaluin research design compline design and design experiment for research									
CO		Explain research design, sampling design and design experiment for research. Collection and representation of data and interpret the data with descriptive statistics.										
CO		Explain to write report, article, reviews etc.										
CO		•	al property right and relat		3							
Unit-		Cont		Contac		Ιο	arni	nα O	utco	ma	KL	
No.		Cont	cnt	Hour		L	41 111	is O	utco			
	Resea	rch Methodology- A	An Introduction-			Knowledge on						
			f research, motivation			fundamental concepts of						
_			nificance of research,	•		research methodology, including the meaning					1.0	
I	criteri	a of good research.	Defining the Research	2							1,2	
	Proble	ems- definition of re	esearch problem,			and objectives of research						
	necess	sity of defining rese	arch problem									
	Resea	rch Design- meanin	g and need of research			Able	to 1	ındeı	rstano	d and		
	design	n, features of a good	design, different		apply	the	e fu	ındar	nental			
	resear	ch designs, Samplin	ng Design- steps in			princi	ples	of	re	search		
	_		Size determination,			desigi		inclu	_	the		
II		~	npling design, different	4			-			sity of	1,2	
	• •		Experimental Design,			resear	ch de	esign				
			xperiment, One – way									
		VA, Two- Way AN										
		22, 23 Factorial Des				<u> </u>	1	1	1 1			
	• •		data collection, tools			_			_	ge on		
		a confection, Nomin - Attitude scale cons	al, ordinal, interval and				-	_		ta and ources		
						and	too.		is so for	data		
III		Use of scale in stati	es, semantic differential	3		anu collec		18	101	uata	1,2	
111		ules for interviews	•	3		COHEC	uoll				1,2	
		ardization, developn										
		ments and item anal	•									
		onnaire	, 515 101 110									
	questi	. CIII WII C										

	Planning and organizing research report, Format		Able to organize and write	
	of research report, Different steps of writing		a comprehensive research	
	report, lay out of the research report, How to		report	
	organize thesis/Dissertation, mechanics of		· r	
	writing research report, standard methods of			
IV	quoting- presenting the result, written and oral	3		1,2
	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	
v	Knowledge and Geographical Indications,	3		1,2
•	Patentable and non-patentable, patenting life,	3		1,4
	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,
114001041	6. Simulation-I using R (Bernoulli, Binomial,	00		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	1, 2, 3
1	research and identify research problems.	1, 2, 3
2	Explain research design, sampling design and design	2,3
4	experiment for research.	2, 3
3	Collection and representation of data and interpret the data	2,3
3	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	UNIVER	RSAL HUMAN VALUE	S (UH	$\mathbf{V}) + \mathbf{P}$	ROFE	SSION	AL E	THIC	S	
Course code	23MSCE121R	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				
Programme		MASTER OF SC								
Semester		Fall/ I semester of fire								
Course	•	udents appreciate the esse		•		•				
Objectives		sure sustained happiness	and pr	osperit	y, whic	h are th	ne core	aspira	tioi	ns of
all human beings						. 1		1	1.0	
	2. To facilitate the development of a Holistic perspective among stu profession as well as towards happiness and prosperity based on a									
	_		_	_	-					_
		reality and the rest of Exis								
		Iuman Values and moven lausible implications of s					-			-
		et, trustful and mutually fu					-			
	interaction wit	•		- manna	n oena	vioi un	a mate	idily Ci		mig
CO1		gy of this course is explor	ational	and th	us univ	ersally	adapt	able. I	t	
	1	ematic and rational study of				•	•			
	existence.									
CO2	It is free from a	It is free from any dogma or value prescriptions.								
CO3	It is a process o	f self-investigation and se	lf-expl	oration	n, and n	ot of g	iving s	ermon	ıs.	
CO4	Whatever is fou	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 the	ir Nat	ural A	cceptar	nce an	d subs	sequ	uent
	Experiential Validation.									
CO5	This process of self-exploration takes the form of a dialogue between the teacher and the									
	_	n with, and then to contin	ue with	in the	student	leadin	g to co	ntinuo	us s	self-
T T •4	evolution.	G 4 4							T:	7.1
Unit- No.		Content					Con Ho	tact	K	KL
	rea Introduction	Need, Basic Guidelines, C	Contoni	t and D	rocoss	for	п	our	1	,2
	e Education	Need, Dasic Guidellies, C	Jonten	and F	10008	101			1	,2
		need, basic guidelines, co	ntent a	nd nro	cess for	r				
	alue Education	need, busic guidennes, co	iitoiit a	ina pro	CC33 10.	L				
	elf-Exploration—what is it? - its content and process; 'Natural									
		xperiential Validation- as				elf-				
	kploration	•								
I 3. C	Continuous Happir	ness and Prosperity- A loc	k at ba	sic Hu	man		-	,		
A A	spirations						'	'		
	4. Right understanding, Relationship and Physical Facilities- the basic									
	requirements for fulfillment of aspirations of every human being with									
	their correct priority									
	5. Understanding Happiness and Prosperity correctly- A critical appraisal									
	of the current scenario									
	Method to fulfill the above human aspirations: understanding and iving in harmony at various levels.									
11	ving in narmony a	u various ieveis.								

	Understanding Harmony in the Human Being - Harmony in Myself!		1,2
	1. Understanding human being as a co-existence of the sentient 'I' and the		
	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		
II	and enjoyer)	10	
	4. Understanding the characteristics and activities of 'I' and harmony in 'I'		
	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.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 Respect (Samman) as the foundational values of relationship		
	3. Understanding the meaning of Vishwas; Difference between intention		
	and competence		
III	4. Understanding the Meaning of Samman, Difference between respect	10	
	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		1,2
	1. Understanding the harmony in the Nature		
	2. Interconnectedness and mutual fulfillment among the four orders of		
IV	nature- recyclability and self- regulation in nature	8	
1	3. Understanding Existence as Co-existence (Sah-astitva) of mutually	ŭ	
	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.		
	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 Humanisti		
V	Universal Order	10	
	4. Competence in professional ethics:		
	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, 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	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	1,3				
	not of giving sermons.	1, 3				
	Whatever is found as truth or reality is stated as a proposal					
4	and the students are facilitated to verify it in their own right,	1, 5				
	based on their Natural Acceptance and subsequent	1, 3				
	Experiential Validation.					
5	This process of self-exploration takes the form of a dialogue					
	between the teacher and the students to begin with, and then	1 5 8				
	to continue within the student leading to continuous self-	1, 5, 8				
	evolution.					

			SEMESTE	R – II	·						
Course Title				CRY (Communicative English & Soft Skill							
Course	code	23UMPD121R	Total credits: 2	L	L	T	P	S	R	O/F	C
	• • •	2701	Total hours: 60P		0	0	4	0	0	0	2
Pre-rec	_	Nil Co-requisite Nil MASTER OF SCIENCE IN ZOOLOGY									
Progra											
Semest Course		1 To familiariza a	Fall/ I semester of						00000	nnioto 11	as of
Object		1. To familiarize students with the transformation of sentences and the appropriate use of prepositions.									
Object	1765	2. To enhance the writing skills in different areas including CV and cover letter writing.									
		3. To convey meaning by reinforcing, substituting for, or contradicting verbal									
		communication.									
CO1		Explain prepositions, tag questions, and idioms correctly.									
CC		Discuss and analyze different sentence types and voices.									
CC		Explain effective paragraphs, precis, and professional documents.									
CC			nalysis, goal setting,						S.		
CC	כע		pal communication and						4		TZT
Unit-		Conte	nt	Con			Learn	ing O	utcom	e	KL
No.	~			Но	ur						
	Gram						-			rs and	
_		of Prepositions			_	refine grammatical accuracy in communication.					1,2
I	_	questions		10	U						
		ms, Phrases and Cla									
		ple, complex, comp	ound sentences								
	Gram									to use	1.0
II		tive and Passive Voice			0	each voice effectively to suit the context and tone.					1,2
		ect and Indirect Spec	ech								
		ting Skills				Develop clarity in writing by eliminating ambiguity and					
		e Basics of Writing; avoid ambiguity and gueness ragraph Writing			15						
	_					vague expressions which					1,2
III						helps to focus on precise and					
	• Prec	eis Writing			concise communication.						
	• Lett	er Writing									
	• Resi	ume, CV and Cover									
	Self-N	Janagement Skills			Learn to identify personal						
	• SW	OT Analysis				strengths, weaknesses,					
		-Regulation- Goal S	Setting			opportunities, and threats for personal growth and self-					
		sonal Hygiene	~								
		Verbal Communic	ation-Sciences of			impre	oveme	nt.			
	Body	Language									
	• Wha	at is Non-Verbal Co	mmunication &			Identify and interpret different forms of body					
	Bod	y Language,									
	• Eler	nents of Communic	ation,	15	language in personal and						
IV	• Typ	es of Body Languag	ze.		5	professional settings.					
		ortance and Impact									
	_	es of Communication									
		guage,	og.i 20aj								
	1	oduction to Haptic,	Introduction to								
		esics,	ma oduction to								
		•	00								
		oduction to Proxemi									
		y Language Do's ar	nd Don´ts, Doubt								
	Clea	aring Session.									

Ī		Group Discussion (Theory)		Understand the relevance of		Ī
		• Importance,		group discussions and		
	T 7	• Planning, Elements, and Skills assessed;	10	develop strategies for starting	1.2	
	V	• Effectively disagreeing,	10	amoun discussions confidently	1,2	
		• Initiating,		group discussions confidently and effectively.		
		• Summarizing and Attaining the Objective		and effectively.		

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							
-	principles.	1, 2, 4, 8							
5	Illustrate non-verbal communication and body language	1, 2, 4, 8							
	concepts.	1, 2, 4, 6							

SEMESTER – III												
Course Tit	le	ORNAMENTA	L FISH F	ARMIN	G (TPS	5-II)						
Course cod	le 23MSZO213R	Total credits: 2	I	T	P	S	R	O/F	C			
		Total hours: 60P	(0	4	0	0	0	2			
Pre-requisi	ite Nil	Co-requisite				Nil						
Programm	e	MASTER OF SCIENCE IN ZOOLOGY										
Semester		Fall/ I semester of first year of the programme										
Course	1. To inculcate in	1. To inculcate importance of ornamental fish farming in relation with entrepreneurship										
Objectives	development.											
	2. To give studer	2. To give students knowledge about ornamental fish rearing to make them self-										
	sustainable.	sustainable.										
	3. To teach techn	iques of constructio	n of glass a	aquarium	and its	maint	enanc	e.				
CO1		al fish and aquariun	•									
CO2		of aquaria and apply										
CO3	Demonstrate reari	Demonstrate rearing of indigenous ornamental fish and estimate physico chemical										
	characteristics of	•										
CO4	Analyse physico-	chemical characteris	tics of aqua	arium wat	ter, de	sign	and	d cons	truct			
		piological filter for culturing plankton.										
CO5	Analyze ornamen	tal fish farms throug	h field visi	risits.								
Unit-No.	Cont	ent	Contact	Learning Outcome								
			Hour									
	Ornamental fishes	and plants		Students will be able to								
	• Identification of co	ommon ornamental		identify common Ornamental								
I	fishes.		15	Fishes and common aquarium					1,2			
	• Identification of co	mmon aquarium		plants								
	plants.											
	Designing and setting	ng up of aquarium		Students will be able to								
II	Aquarium designing	ng and equipments.	10	design a					1,2			
11	Setting up and man	intenance of fresh	10	maintain aquaria					1,2			
	water aquaria.											
	Rearing and physic	o-chemical		Students	s will be	e able	to rea	r				
	parameters of aqua	rium water		Indigeno	al fish	in						
III	• Rearing of indigen	ous ornamental	15	Aquariu	m and	able to	o do		1,2			
111	fish in aquarium.		13	estimati	on of P	hysico)-		1,2			
	• Estimation of phys	sico- chemical		chemica	l chara	cterist	ics of					
	characteristics of a	quarium water.		Aquariu	m wate	er						
	Biological filter and	plankton culture		Students	s will	be	able	to				
IV	• Preparation of biol	-	10	Constru	ct biolo	ogical	filter	and	1,2			
1 4	removal of ammon		10	develop	plankto	on cul	ture		1,2			
	Culture of plankton	ns.										
	Field study			It will h	_		nts to g	get				
\mathbf{V}	Visit to ornamental fis	sh farm.	10	broad k		-			1,2			
				orname	ntal fish	ı farm	ing					

- 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	1,8								
	estimate physico chemical characteristics of aquarium water.	1, 0								
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 –	III						
Course	e Title		RESEAR	CH I	ETHICS	8				
Course	e code	23UMRE214R	Total credits: 1	L	T	P	S	R	O/F	C
			Total hours: 15	1	0	0	0	0	0	1
Pre-re	quisite	Nil	Co-requisite				Nil			
Programme			MASTER OF SCII							
Semest			Fall/ I semester of firs							
Course			to lay a foundation for er	•						
Object	tives	_	es, policies, and codes		_	ethical	resea	rch, a	s wel	l as t
C	01		dy of ethical theories, conc							
			ply research ethics theories							
CC		-	ethics issues such as response				and mis	condu	ct.	
CC		Ŭ	ents and results in ethical re				1			
CO		• • • • • • • • • • • • • • • • • • • •	ly procedures for sampling				na repo	rting.		
	<i>ງ</i> ວ		inciples to research design)4 -	I	777
Unit-		Co	ontent		ontact	Lear	rning (Jutcor	ne	KL
No.	БТПІ	CS. Introduction	to the course and each	<u> </u>	Hour	Had	erstand	and		
			o moral theory. Ethics:				y key e			
						y key e ciples a		ral		
		efinition, moral philosophy, nature of moral adgements and reactions. Research regulation;				_	ries in 1			
I			ch ethics. Honesty, candor,		3		exts, cr			1,2
_		compromise and integrity. Data ownership and					uate iss	-		1,2
	_	-	f interest; collaboration.				ed to re		1	
		n and Non-Huma			ethic		504101			
		chers in society.								
			JCT- Ethics with respect to)		Unde	erstand	and		
	scienc	e and research. l	ntellectual honesty and			apply	y ethica	ıl		
	researc	ch integrity. Scier	tific misconducts:			princ	ciples re	elated	to	
	Falsifi	cation, Fabricatio	n, and Plagiarism (FFP).			scien	ntific co	nduct.	,	
	Redun	dant publications	: duplicate and overlapping			demo	onstrate	•		
II	public	ations, salami slic	ing. Selective reporting and	t	2		lectual		y	1,2
	misrep	presentation of dat	ta.				researc			
						_	grity, re	•	ze	
						_	prevent			
						scien				
	Dring	ICATION ETH	ICC Dublication of the				onduct erstand			
			ICS- Publication ethics: and importance. Best				erstand ortance			
			ting initiatives and			_	ication			
	^		ME, etc. Conflicts of			_	gnize b		'	
	_						tices an			
III		interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour				_	dards			1,2
	_	_	iolation of publication		3	Stand	-u1 UD			1,4
		authorship and co	•							
		fication of publication	-							
		_	Predatory publishers and							
	journa		- 1							
	journa	ls.								

IV	OPEN ACCESS PUBLISHING-Open access publications and initiatives. SHERPA/RoME0 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 Journal	3	Understand the concept and significance of open access publishing	1,2
	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, 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. 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							

			SEN	MESTER – I	II							
Course Ti	itle	CORPORA	TE PROFI	CIENCY (C	ommun	icativ	e Engli	ish &	Soft S	kills)		
Course co	ode	23UMPD211R	Total credi	ts: 2	L	T	P	S	R	O/F	С	
			Total hours	s: 60P	0	0	4	0	0	0	2	
Pre-requi		Nil		equisite				Nil				
Programm	me	MASTER OF SCIENCE IN ZOOLOGY										
Semester			Fall/ I semester of first year of the programme									
Course		1. To acquaint students with the various tools of an effective presentation.										
Objective	es	2. To acquire the sp	eaking skill,	instruct, infl	uence, e	ngage	, educa	ite, or	appeas	se the		
		listeners.										
		3. To increase proficiency, presentability and quality of resume and provide guidance for										
CO1			self- promotion and self-evaluation in social media. It will prepare the learners to speak with greater control and charisma in front of others.									
CO1											ers.	
CO2		It will arm the stud			_						- o 1	
CO3		It will arm the stude resume.	ents with all	me necessary	y toois ai	iu skii	isets to	prepa	re pro	ressior	ıaı	
CO4		They will learn to l	nighlight and	l access them	selves ir	cocia	l medi	a				
CO5		It will impart in the							w dev	velon		
003		strategies to crack									dence	
Unit-	ļ	Content	inter vie ws, i	Contact			ning O				KL	
No.		002200220		Hour								
	Pres	sentation Skills			Unders	tand tl	he imp	ortanc	e of			
	• Int	roduction		present		_			nd			
	• Es	sential characteristic	es of a		professional contexts. It also helps					ps		
I	go	od presentation		4	to recog	gnize l	key ele	ments	that		1,2	
	• Pre	eparation of a good			make a presentation effective					ıch		
	pre	esentation		as clari	ty, eng	gageme	ent, an	d				
					structui							
		lic Skills			Learn p	-	-	_		al		
		ar of Public Speakin	-		strategi		_	and r	educe			
		derstanding and Ov	_		speakir	ig anx	iety.					
		ar of Public Speakin onfidence and Contro	-									
		ysiology and Stress	,									
		ontrol/Process,	-									
		os for Presentations	and Public									
II	_	eaking,	una i done	20							1,2	
	_	os for Using Visual.	Aids in	_,							-,-	
	•	esentations,										
	• Pro	ocess for Preparing	and									
	Cr	eating Presentations	,									
	• De	livering Presentation	ns									
	Su	ccessfully,										
		oubt Clearing and Su	ımmary of									
	Ma	ain Points										

	Practical session on Resume,		Gain expertise in drafting	
	Curriculum Vitae, Writing cover		impactful cover letters and learn to	
	letter & LinkedIn Profile		create tailored resumes that	
	Preparation, submission &		highlight relevant skills and	
III	screening of Resume.	10	achievements.	1,2
	Practical session on cover letter			
	screening session			
	Creating a profile on LinkedIn			
	How to utilize it			
	Leadership & Management		Understand the fundamental	
	Skills		principles and importance of	
	Concepts of Leadership,		leadership in various contexts.	
	• Leadership Styles,			
	Manager VS Leader,			
IV	How to be an Effective Leader,	20		1,2
1 4	Mock/ Practice Session,	20		1,2
	Doubt Clearing Session.			
	Research Paper – Writing Skills			
	How to write a research paper			
	Key point in Research Work			
	No. 1. Testermine		Tiles (Constitution of the Constitution of the	
	Mock Interview		Identify critical aspects of	
	Practical Mock Interview, Fig. 11 and Practicing Fig. 11 and 12.		conducting research, including	
	Feedback- Receiving Feedback, Civing Feedback		hypothesis formation and data	
V	Giving Feedback, Advantages of effective.	6	analysis	1,2
	Advantages of effective Feedback,			
	· · · · · · · · · · · · · · · · · · ·			
	How to deal with negative feedback.			
	reedback.			

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							

			SEMESTE	ER – III								
Course T	itle		ANIMA	AL PHY	YSI	OL	OGY					
Course c	ode	23MSZO216R	Total credits: 4	I	L	T	P	S	R	O/F	C	
			Total hours: 45T+3	30P 3	3	0	2	0	0	0	4	
Pre-requ	isite	Nil	Co-requisite						Nil			
Program	me	MASTER OF SCIENCE IN ZOOLOGY										
Semester	•	Fall/ I semester of first year of the programme										
Course		1) To provide knowledge of animal body system to reveal physiological homologies,										
Objective	es	• •	nysiological adaptation									
			various principles	that un	der	lies	highe	er lev	vel 1n	tegrative	bodily	
		functions.	1 ' 1	1 1		c c	,•	1			.1	
		-	a comprehensive kn	_				_	-		-	
COI			animals ranging from epts of gas exchange									
COI	L	in humans and a		iii iuiigs	am	u um	iciciii	types	01 168	spiratory j	orginems	
CO2			ction of heart as a pur	mn and a	con	nect	ing tis	sues				
CO3			response to differen	_						in under	standino	
			ion and controlling bo		145	una	uomi	<i>y</i> 01	Orum	in anaci	, tunianis,	
CO4		·			vn	of	compl	ex f	oods,	assimila	ion and	
			Illustrate the mechanism of breaking down of complex foods, assimilation and elimination of the nitrogenous wastes									
CO5	'	Discuss sensory	Discuss sensory organs (ear and eye) and the perception prepared by the brain.									
Unit-		Cont	ent	Conta	act		Lea	rning	g Out	come	KL	
No.				Hou	ır							
	Resp	iratory physiolog	3y			T	o unde	erstan	d the	concepts		
		spiratory pigment	~				-		-	the lungs		
		nocyanin, erythro					nd diff					
		orocruorin and had	*				espirat		-			
		monary circulation				h	umans	and	anima	ls.		
		change through me										
		sues: Fick's Law, piratory membran										
I		fusion	c, diffusion and	7							1,2	
			n dioxide transport									
		ygen dissociation	-									
	effe											
	• Ch	emical and neura	l regulation of									
	res	piration (briefly)										
• A		riation, space and deep-sea diving										
		ysiology										
		liovascular physi					o unde					
		nposition of blood					ınctioı					
II		mopoiesis, Lymphatic system and pump and the blood and lymph as connecting 1,2										
11	Lyn	-	different animals	10			_			ng es and	1,2	
		efly), Origin and o					utrient		• •	cs and	bodily athways es. bigments standing, ion and KL	
		liac impulse	onauction of the							d heart.		
	card	in puise					J.11 t11	- 4100	un	11vu1t.	ı	

	Nerve and muscle physiology		To understand and analyze	
	Sensory parts: Sensory receptors,		the ways in which we	
	Motor Parts: Effectors		perceive the world around	
	Processing of information, Storage of		us and our response to	
III	information Synaptic transmission,	10	stimuli along with the	1,2
	neurotransmitters		knowledge of how the brain	
			stores and understands the	
			information gathered to	
			control our entire body.	
	Gastrointestinal and Renal physiology		To understand the breaking	
	• Digestion, absorption and assimilation;		down of complex foods into	
	Energy balance and BMR: Definitions;		nutrients that are necessary	
	Patterns of nitrogenous excretion in		for our body, assimilation	
IV	different animals; Counter- current	8	and elimination of the	1,2
	exchanger in the kidney;		nitrogenous wastes	
	• Regulation of urine formation;		produced as a result of	
	Acid base balance (blood and kidney);		breakdown and	
	Homeostasis		utilization in the body.	
	Special Senses		To understand that the eye	
	Vision: The retina structure and		and ear function as sensory	
	photochemistry of vision and		organs and the visual and	
\mathbf{v}	function of the visual cortex	10	audio perception is done by	1,2
'	Hearing: The organ of Corti: structure	10	the brain	1,2
	and function, auditory nervous			
	pathways and function of the cerebral			
	cortex in hearing, Bioluminescence			
	Estimation of free amino acid using			
	ninhydrin reagent.			
	Blood glucose test.			
	Measurement of lung volume by			
	spirometry.			
Practical	• Erythrocyte Sedimentation Rate (ESR).	30		1224
Practical	Dissection to show the striated muscle	30		1,2,3,4
	structure of an invertebrate and			
	vertebrate.			
	Dissection of a sample of goat spinal			
	cord to demonstrate the structure of			
	neurons.			

- 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: https://swayam.gov.in/nd1_noc20_bt42/preview
- 2. Physiology and Biochemistry: https://swayam.gov.in/nd2_cec20_bt19/preview
- 3. Animal Physiology: https://www.classcentral.com/course/swayam-animal-physiology-12894
- 4. Respiration in the Human Body: https://www.classcentral.com/course/edx-respiration-in-thehuman-body-3050
- 5. Introduction to Brain & Behaviour: https://swayam.gov.in/nd1_noc20_hs33/preview
- 6. Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
- 7. https://www.ncbi.nlm.nih.gov/books/NBK459327/
- 8. https://hearinghealthfoundation.org/how-hearing-works
- 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 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 brain in understanding, storing information and controlling body.	1,3					
4	Illustrate the mechanism of breaking down of complex foods, assimilation and elimination of the nitrogenous wastes	1,3					
5	Discuss sensory organs (ear and eye) and the perception prepared by the brain.	1,3					

SEMESTER – III										
Course Title DEVELOPMENTAL BIOLOGY Course code 23MSZO217R Total credits: 4 L T P S R O/F										
Course cod	le 23MSZO217R	Total credits: 4			T	P	S	R	O/F	C
		Total hours: 45T		3	0	2	0	0	0	4
Pre-requisi		Co-requisite					Nil			
Programm	e	MASTER O								
Semester		Fall/ I semester								
Course	_	he knowledge of p	-		•		elopme	nt in o	rganisı	m.
Objectives	2. To impart the	knowledge of organ	nogenesis	in or	rganisı	n.				
		wledge on metamor								
CO1	_	terminology of an	imal deve	lopn	nent, p	ore and	l post f	fertiliz	ation e	events
	and morphogenes									
CO2		e regulations in axis	s and patte	ern f	format	ion in (drosopl	hila, aı	nphibi	ia and
002	chick.	C C			• `					
CO3		ess of organ formation	` U							
CO4		anism for regenerat rphosis and types o								
Unit-No.	Conte		Contact	_	To	ornino	Outco			KL
OIIIt-140.	Contr		Hour		Le	ai iiiig	Guice	лис		KL
	Modern concepts of	development	Hour	St	tudents	s will h	e able	to exp	ain	
	• Potency									
	Commitment	•			the key concepts of development, including potency, commitment, cell fate etc. with an understanding of					
	 Specification 									
	• Induction	•								
	Competence					_	cesses o		ute	
	 Determination 	-			organ	ismal o	develop	oment.		
	 Differentiation 									
	• Cell fate and cell l	ineages								
	• Stem cells									
	Genomic equivaler	ice								
	• cytoplasmic determ	inants								
_	 Imprinting 		_							
I	 Mutant 		7							1,2
	• Transgenics in ana	alysis of								
	development.									
	Fertilization	ection ovents								
	 Pre and post fertiliz Activation of eggs	ation events,								
	Activation of eggsGamete fusion									
	 Prevention of phylo 	ngeny								
	Morphogenesis and									
	• The thermodynam									
	interaction	301 31 0011								
	Concept of morpho	gen gradients and								
	morphogenetic field									
	• Cell adhesion mole									
			<u> </u>							

	Morphogenesis in organism		Students will be able to	
	• Cell aggregation and differentiation		describe the processes of	
	in Dictyostelium,		morphogenesis.	
	Axis and pattern formation in		morphogenesis.	
	Drosophila: Maternal effect genes,			
II	_	10		1,2
	gap genes, pair rule genes, segment			
	polarity genes, homeotic genes and			
	hox genes in development.			
	Axis and pattern formation in			
	amphibian and chick.		G. 1	
	Organogenesis in animals		Students will be able to	
	• Vulva formation in <i>Caenorhabditis</i>		explain the processes of	
III	elegans	10	organogenesis in animals.	1,2
	Eye lens induction			
	Limb development			
	Regeneration		Students will be able to	
	Epimorphic regeneration of		compare different types of	
***	Salamander limbs	0	regeneration, including	1.0
IV	Morphallactic regeneration in hydra	8	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.	
	Chromosomal sex determination in			
v	mammals	10		1,2
•	Programmed cell death	10		1,2
	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.			
	• Preparation of whole mount of			
	chick embryo of 13-18, 24-33, 36-			
Practical	48 and 48-72 hours and identification of the developmental	30		1,2,3,4
	stages.			
	 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	1,3					
1	and post fertilization events and morphogenesis.	1,3					
2	Describe the gene regulations in axis and pattern formation in	1 2					
	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					

		SEMESTER –	III							
Course Ti	tle	AQUAC	CUI	LTUI	RE					
Course co	de 23MSZO218R	Total credits: 4	L	T	P	O/F	С			
		Total hours: 45T+30P	3	0	2	0	0	0	4	
Pre-requis	site Nil	Co-requisite					Nil			
Programn	ne	MASTER OF SCI	EN	CE II	N ZO	OLC	GY			
Semester		Fall/ I semester of firs	t y	ear of	f the	prog	ramm	e		
Course		designed to provide in dept	h k	nowl	edge	of dif	ferent	aquatic eco	systems	
Objectives	1	ypes of fish cultures.								
	-	eoretical knowledge on pre		_		-	_			
001		wledge on different aquacul			fish i	dentif	rication			
CO1		ts of different aquatic ecosy	/ste	ems.						
CO2		of aquaculture methods.	1,							
CO3		l identify species for aquac								
CO4		cking procedure and manag								
CO5		ocking procedure and mana	iget			T	•	0.4	177	
Unit-No.		Content		Con		Lea	ırnıng	Outcome	KL	
	Aquatic Ecosystems			по	ur	Ctu	lanta rr	ill learn		
	ecosystems;	Freshwater ecosystems - Lotic and Lentic					different aquatic systems			
I	•	Marine ecosystems - oceans and seas, zonation			•	Syst	CIIIS		1,2	
_		of the seas - rocky, sandy and muddy shores;							1,2	
	•	classification of marine habitat - pelagic,								
		benthic, neritic, oceanic, littoral and abyssal.								
	Aquaculture system					Stuc	lents w	ill learn		
	 Scope and definition 	Scope and definition; origins and growth of					different			
	aquaculture; biolog	ical and technological basis	s;		types of			uaculture		
п	• Traditional, extensi	Traditional, extensive, semi - intensive and				methods				
11	intensive culture; n	intensive culture; monoculture, polyculture,					1,2			
	•	composite culture, mixed culture, mono sex								
	_	culture; cage culture, pen culture, raft culture,								
	sewage – fed fish c									
		nd species for aquaculture	:				ill help			
	Survey and location						lents fo			
	1 0 1	haracteristics; water					ction a			
III	source; hydromete	erological data.		10	0			f species	1,2	
	Biological charact	eristics of aquaculture				ior a	aquacu	Iture	1,2	
	_	species; economic and market								
	considerations; seed resources, collection									
	and transportation									
	Pre-Stocking Mana	gement:					ill help			
	• Sun drying, ploug	• Sun drying, ploughing / tilling, desilting,					ents to			
IV	_	ation, eradication of weed		8	}		-	ocking	1,2	
	fishes.			8	8	processes		1,2		
	Stocking: Acclimate	atization of seed and release	e;							
	species combination	ons; stocking density; ratio.								

	Post Stocking Management:		It will help the	
	Water and soil quality parameters required for		students to get the	
	optimum production, control of aquatic weeds		knowledge	
v	and aquatic insects, algal blooms;	10	Regarding	1,2
•	Specific food consumption, food conversion	10	different post	1,2
	ratio (FCR), protein efficiency ratio, true net		stocking	
	protein utilization, apparent net protein		management	
	utilization, biological value of protein.			
	Determination of water temperature, pH,			
	salinity, turbidity.			
	Analysis of total alkalinity of water.			
	• Determination of total hardness of water.			
Practical	Estimation of dissolved oxygen, BOD of	30		1,2,3,4
Tacucai	water.			1,2,3,4
	• Estimation of phosphates and CO ₂ .			
	Dissection of pituitary gland of fish.			
	Estimation of primary productivity using dark			
	and light bottle.			

- 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. (3rdEdition) 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 – III										
Course Title		ANIMA	L DIV	ERS	ITY					
Course code	23MSZO219R	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	;				N	il		
Programme		MASTER OF S	CIENC	E IN	ZOC)LO	GY			
Semester	I	Fall/ I semester of f	first ye	ar of	the p	rogra	amme	:		
Course	1.To impart the know	ledge on concept of	f biolog	gical d	liversi	ity an	d its i	mport	ance.	
Objectives	2. To provide the info		adaptati	ion of	f anin	nal di	versit	y and	their	
conservation approaches.										
	3.To provide knowled			ls and	d thei	cons	servati	ion st	rategy.	
CO1	Describe animal king									
CO2	Explain animal divers									
CO3	Describe salient featu		n of life	e form	ıs.					
CO4	Analyse adaptations i									
CO5	Describe the conserva									
Unit-No.	Conte	ent	Cont			earn	ing O	utcoi	ne	KL
	T . T	7 70	Hou	ur			***			
	Introduction to anim	•					will u			
	Biodiversity: Cond	1				_	tance	B1010	gicai	
	diversity;					diversity				
I	Global biodiversity hotspots; RAMSAR convention and									1,2
	RAMSAR convention and RAMSAR sites.									
	Outline of Anima Classification with									
	Animal diversity in	_			Stud	lonte	will be	a abla	to	
	 General profile of 				knov					
	resources, endemi									
II	threatened species		10)	profile of India, concept of protected areas.					1,2
	Protected areas: B				or p		iou ure			1,2
	reserve, national p	_								
	sanctuaries									
	Salient features and	composition of			Stu	dents	s will l	know		
	life forms:	1					g salie			
	Salient features and	d composition of			_		and co		sition	
TTT	life forms in terres	_	10				orms.	-		1.0
III	cavernicolous ecos	•	10	,						1,2
	Salient features and	d composition of								
	life forms in freshv	vater, estuarine and								
	marine ecosystem									
	Adaptations in anin	nal diversity:			Stu	dents	s will l	have l	oasic	
	• Terrestrial, desert a	and aquatic					adapti			
	adaptation						ties of	anim	nal	
IV	Animal diversity as	nd human health:	8		div	ersity	у.			1,2
	Important pathoger	nic life forms								
	Animal diversity as									
	Ethnozoology and	Zootherapeutic								

	Conservation and management of		Students will have	
	wildlife:		understanding on	
	• Principles of conservation,		different conservation	
	biodiversity management		programme adopted in	
	approaches		India for the conservation	
	Human wildlife conflict; Peoples		of animal diversity.	
*7	participation in managing	40		1.0
V	protected areas	10		1,2
	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	1, 3, 8				
	conservation of wildlife.					

	SEMESTER – IV									
Course Title	RESEARCH/DATA ANALYSIS/DOCUMENTATION-R4									
Course code	23MSZO221R	Total credits: 12	L	T	P	S	R	O/F	С	
	25W15ZU221R		0	0	20	8	4	0	12	
Pre-requisite	Nil	Co-requisite				Nil		•		
Programme		MASTER OF SCIE	NCE 1	N ZO	OLOG	ξY				
Semester	Fa	all/ I semester of first	year o	of the	progra	mme				
Course	Research Problems in	Research Problems in Entomology/Fish Biology and Fisheries/Molecular Cell Biology								
Objectives	is a project-based fact	ulty supervised research	ch cou	rse. Th	is cou	rse aim	is to gi	ive stud	lents	
	hands-on laboratory of	or field experience that	can b	e trans	lated in	nto car	eer fie	elds in		
	Entomology/Fish Bio	ology and Fisheries/Mo	olecula	r Cell	Biolog	y.				
CO1	Students should demo	onstrate critical thinkir	g skill	s throu	ıgh est	ablishi	ng me	thods t	o test	
	a hypothesis;									
CO2	Students can analyse	and interpret results a	nd disc	uss fir	dings.					
CO3	Students should demo	onstrate technical com	petenc	y and e	ethical	labora	tory co	onduct.		
CO4	Students should be ab	Students should be able to synthesize scientific literature to their experiments.								
CO5	Students can effective	ely communicate their	findin	g to a	scienti	fic aud	lience.			

	CO PO Mapping					
SN	Course Outcome (CO)	Mapped Program Outcome				
1	Students should demonstrate critical thinking skills through establishing methods to test a hypothesis;	1, 2, 3				
2	Students can analyse and interpret results and discuss findings.	1, 2, 3				
3	Students should demonstrate technical competency and ethical laboratory conduct.	1, 2, 3				
4	Students should be able to synthesize scientific literature to their experiments.	1, 2, 3				
5	Students can effectively communicate their finding to a scientific audience.	1, 2, 3				

			SEMESTI	ER – IV							
Course Tit	le	ENTOMOLO	GY I (INSECT BIO		COLOGY	AND	PEST I	MANA	GEM	ENT))
Course cod	le	23MSZO222R	Total credits: 2	I	T	P	S	R	O/F	' (С
			Total hours: 30T	2	0	0	0	0	0	2	2
Pre-requisi	ite	Nil	Co-requisite	:			Nil				
Programm	e		MASTER O	F SCIENO	CE IN Z	OOL	OGY				
Semester			Fall/ I semester	of first ye	ar of th	e prog	ramm	e			
Course		1. To provide	the knowledge on	morphol	ogical a	nd					
Objectives		2. To know th	e anatomical struc	ture of in	sects an	d thei	r role	in eco	syste	m.	
		3. To give known	owledge on vector	borne dis	eases, p	est co	ntrol a	ind m	anage	ment	t.
CO1		Explain Class In	secta and describe n	norpholog	y of inse	cts.					
CO2		Illustrate and pla	n pest management	approache	es.						
CO3		Describe role of	insects in an ecosys	tem.							
CO4			eases caused by inse		eir contr	ol mea	sures.				
CO5	1		mechanism of insec		1						
Unit-No.		Conto	ent	Contact	L	earni	ng Out	come		KI	L
				Hour							
		eral morphology	of insects and				l acqui	re			
	func				know	_	, .	ı	c		
		ructure of insect h	•		_		orphol		[
	abdomen, insect integument,						endage	es or			
	-	• Type of mouthparts, antennae, legs and their modifications & function,			insect	S					
I		 Wings, wing structure, venations and wing coupling, Insect eye: structure & function, 		7						1,2	2
		ceptor organs in									
		ceptor organs in septors, mechanor	·								
		otoreceptors,	eceptors und								
		•	ducing organs in								
		ects.	2								
	Inse	ct pest control a	nd management:		Stude	nts wi	ll able	to k	now		
		mary control me	_		differ	ent m	ethods	of	pest		
	• Ho	ormonal and Pher	omonal control		mana	gemen	ts				
II	• Bio	ological control		10						1,2	2
		ant resistance to in	nsects								
			pproach in pest								
		nagement.	^								
	Maj	or Ecological Ro	le of Insects:		Stude	nts wil	l know	regard	ding		
	• Ins	sects as herbivore	S		differ	ent rol	e of ins	sects in	n an		
	• Ins	sect as pollinators			ecosy	stem					
	• Aq	uatic insects									
III	• Ins	sects as parasites	and predators	10						1,2	2
	• Ro	le of insects in fo	rensic sciences								
	• Ins	sect biotic potenti	al and								
	en	vironmental resist	tance								
	• Ins	sect as human foo	d.								

	Insects of medical Importance:		Students will have basic idea	
	• Life cycle, Mode of transmission and		on various diseases that are	
IV	epidemiology of major vector borne	8	caused by insects and their	1,2
	diseases such as Malaria, yellow fever,		control measures	
	kalazar, typhus, plague, filiariasis.			
	Defense Mechanism in Insects:		Students will have	
	Behavioural and structural defense,		understanding on different	
	• Chemical defense,		behavioural mechanism in	
	Coloration defense		insects	
	Mimicry.			
	• Adaptation of insects in terrestrial and			
	aquatic environment			
	Insect Behavior:			
	• Chemotropism, thigmotropism,			
	hydrotropism, rheotropism,			
V	anemotropism, phototropism,	10		1,2
	thermotropism, geotropism, instinct	10		1,2
	Protective behaviour: mimicry.			
	Crypsis, warning coloration.			
	Behavioural defence, chemical defence.			
	Breeding behaviour.			
	Insect associations: Passive insect			
	association, active associations,			
	estivating aggregation, protective			
	aggregation, swarming aggregation,			
	sleeping aggregation, dissociation,			
	social aggregations			

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	Course Title ENTOMOLOGY II (INSECT PHYSIOLOGY AND TOXICOLOGY)												
Course coo	de 23MSZO223R	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								L					
Programm		MASTER OF SCI	EN(E IN	ZOO	OLOGY	7						
Semester		Fall/ I semester of fir											
Course	1. To understar	nd the basic concept of inse	ect p	hysiol	ogy a	and inse	ct beh	aviour.					
Objectives		2. To provide the knowledge on pesticides and its toxicity.											
	3. To impart kr	nowledge on different com	muni	cation	strat	egy in iı	sects						
CO1	Describe the en	docrine system and their in	ıflue	nce or	n phy	siology	of ins	ects.					
CO2	Explain physiol	ogical system of insects.											
CO3	Describe insect	's communication and its s	ignif	icance	e.								
CO4	Describe the tox	xicity of pesticides and the	ir eff	ects o	n ins	ects.							
CO5	Identify pesticion	les and explain their mode	of a	ction i	n coi	ntrolling	insec	ets.					
Unit-No.		Content		Cont	act	Lear	ning	Outcom	e	KL			
				Hot			0						
	Insect Physiology:					Studer	nts wi	Il acquire					
	Digestive system, R	espiratory system,						egarding					
I	Circulatory system,			7		the en	docrir	ne system		1,2			
	Reproductive system, Excretory system.							luence or					
						physic	logy	of insects					
	Endocrine system: Insect hormones-with reference to metamorphosis and reproduction.					Students will able to							
				10		know a	ow about Different						
II				10	,	physiol	ogical	l system o	of	1,2			
						insects.							
	Social insects and	l communication: Social				Studer	nts wi	ll acquire					
	Insects, Social organ	nization, Caste				knowl	edge (on insect					
	differentiation, Hon	ey bees, Termites and ants	3			comm	unicat	ion and i	ts				
III	as social insects			significance.						1,2			
	Insect communicat			10						1,2			
		communication, Audio and tactile											
	communication, Vis												
	Luminescent insects												
	_	ticides: LD50 and LC50,				Studer							
		tionship, Carcinogenic,		basic idea on									
IV	_	ratogenic effects; Method of	of	8		toxico	••			1,2			
	_	on insect and evaluation of				_		nd their					
	toxicity.					effect							
	Group characterist					Studer							
	-	hlorines, Organophosphori	1S			unders		-					
	insecticides,					differe	-	-					
		Carbamates, Pyrethroids, other plant origin bio-				_		nd their					
V	insecticides, neonicotinoids and nitrogenous)	mode	ot acti	on.		1,2			
	_	nts; IGRs, attractants,											
	-	eedants. Properties of few											
		es i.e. DDT, HCH (BHC),											
		n, Parathion, Malathion,											
	Carbaryl, Cypermet	hrın etc.											

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								
Course Title	FISH BIO	DLOGY AND FISHERI		n physio	logy a	nd Fis	sh cultu	re)			
Course code		Total credits: 2	L	TP	S	R	O/F	C			
	Total hours: 30T		2	0 0	0	0	0	2			
Pre-requisite	Nil	Co-requisite		l .	.1						
Programme		MASTER OF SC	IENCE I	N ZOOI	LOGY	7					
Semester		Fall/ I semester of fi									
Course 1. To impart knowledge on the classification of major groups of fishes					ishes a	nd their	•				
Objectives	_	important characters.									
	2. Acquire know	Acquire knowledge on fish physiology and fishery management.									
	3. To provide k	nowledge on different fis	h diseases	•							
CO1	Classify fish into	o appropriate groups base	d on their	key cha	racteri	stics.					
CO2	Describe respira	tion and excretion of fish	•								
CO3	Discuss food and	d feeding habit of fishes a	and the dig	estive sy	stem	of fish	es				
CO4	Explain types of	fish diseases, their symp	toms and o	control.							
CO5		ntal fishes of North East			e fish	farmir	ıg, fishi	ng gears			
	and crafts.							-			
Unit-No.	(Content	Contact	Le	arnin	g Outc	ome	KL			
			Hour								
	Fish classification	and skeletal system		Stude	nts wi	ll learn	l				
		ers and classifications,		_			stics of				
I		os (extant and extinct).	7		fish along with			1,2			
	• Epidermis, Exos				on of m	ajor					
	Cardio vascular system of fishes.			fish g							
	_	excretory system of				ll learn					
	fish			_		and ex	cretion				
	• Structure and fur			in fisl	nes						
	breathing organs										
II		Swim bladder and its modifications						1,2			
		Weberian ossicles and its function									
	• Excretion: kidne	ey, structure and									
	function										
	•	in fresh water and									
	marine teleost.	1 1. 4 6 6° - 1		C41-		11 1					
	Food and feeding					ll learn	l				
	• Food and feedin				-	it and					
	Digestive system			diges	tion of	HSII					
III	 Modifications of 	and its modifications	10					1,2			
		lysis: Index of fullness,									
	Ponderal index, and Gastro-somatic index.										
	Fish diseases Dise	2956		Stude	nte wi	11 learn	<u> </u>	1			
		on, Disease problems.					of fish				
		es: viral, bacterial,			7	_	control				
IV	fungal, protozoa		8	measi		. 111011	COMMON	1,2			
		d control measures,		1110000				1,2			
		Biochemical assay,									
	· ·	hniques, vaccines.									
	Derotogical acc	iniques, raccines.	<u> </u>					1			

	Fish culture		Students	will	learn	
	• Ornamental fish, culture of ornamental	fish, culture of ornamental				
	fishes, Ornamental fishes of northeast					
	India.					
v	• Fish farming: Integrated and composite	10				1,2
V	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	V							
Course Tit		FISH BIOLOGY A								
(Fish reproductive biology, endocrinology and fish get Course code 23MSZO223R Total credits: 4 L T P S								. 1		
Course coo	de 23MSZO223R		L	T	P	S	R	O/F	+-	C
		Total hours: 45T+30P	3	0	2	0	0	0		4
Pre-requis		Co-requisite	NOT I		00100	Nil				
Programm	ie	MASTER OF SCIE								
Semester	1 771 '	Fall/ I semester of first					.•	1		
Course		s designed to provide in dep	th kno	wled	ge of re	produc	tive ar	id sei	isor	У
Objectives	_			4 ! .	1 6 .	1. 1	1 1			
	-	eoretical knowledge on fish								
CO1		owledge on endocrine systems of sensory organs, pattern,								
			, and m	еспа	unsin oi	11811 11	ngrauc	JII.		
CO2	•	roductive organs of fish.								
CO3	•	ne system in fishes.	1 1		C* 1					
CO4	_	difications of hill stream an				•	1 .			
CO5		etics and apply bioinformation		ods	tor man	agıng o	iata an	d reti	ievi	ıng
TT '4 NT		rmation in connection to fish		4		. 0		1	TZ	-
Unit-No.		ontent	Conta Hou		Learning Outcome		ie	K	L	
	Chamanaantana and	miquotion	пои	II	Studen	+a ***:11	10000			
	Chemoreceptors and	0								
	•Structure of olfactory system, morphology of peripheral olfactory organ, cellular				Sensor			h		
				and Mi	granoi	1 01 118	11			
	_	composition of olfactory epithelium, olfactory bulb and central projections. Structure and								
	functions of taste buds.									
I	• Migration infishes: Types Anadromous,								1,	2
	Migration nfishes: Types Anadromous, Catadromous, Amphidromous, factors									
	_	responsible for migration (Intrinsic and								
	_	environmental), periodicity of migration. Role								
	· -									
		of hormones in migration, Orientation and Navigation during migration.								
	Reproductive system				Studen	ts wi	ll lea	ırn		
	<u>*</u>	productive system. Stages			Reprod					
	of maturation.				of fishe					
	• Mechanism of spern	natogenesis and its								
II	hormonal control. G	onado- somatic index,	10						1	2
11	Modified Gonado-so	matic index and Dobriyal	10						1,	2
	index.									
	•Structure of female r	tructure of female reproductive system. Stages								
	of maturation. Ooger	of maturation. Oogenesis, egg development,								
	hormonal control of	oogenesis.								
	Endocrine system				Studen		_	e		
		and functions of pituitary			knowle	-				
III	gland in fishes. Struc		10		Endoci	ine sys	stem in	1	1,	2
	functions of other en	-			fishes				- •	
	. –	alamo- hypophysial system								
	in fishes. Neurohorm	nones and their functions.								

IV	 Adaptation in fishes Adaptation in Hill Stream Fishes Adaptations in deep sea fishes Sexual dimorphism, mating and Parental care. Lateral line system infishes. Larvivorous and exotic fishes. Genetics and bioinformatics Genetics, Biotechnology and Aquaculture. Introduction to Bioinformatics: FASTA, 	8	Students will learn Modifications of hill stream and deep sea in fishes It will help the students to get the knowledge Fish	1,2
V	BLAST, Databases • Application of Bioinformatics in Fishery, Barcoding, Genetic diversity and phylogenetics	10	Genetics and Bioinformatics	1,2
Practical	 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 (Gonadosomatic index (GSI), hepatosomatic index (HIS)). Determination of length-weight and length-length relationships. Determination of Condition Factor (CF), Absolute and Relative fecundity. Identification of fishing gears. Analysis of water samples for 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. 	30		1,2,3,4

- 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. and Kapoor, 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	1, 3					
	of 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.						

Course Title MOLECULAR CELL BIOL Course code 23MSZO222R Total credits: 2 L T	LOGY P		<u> </u>	·					
Course code 23MSZO222R Total credits: 2 I T	P		MOLECULAR CELL BIOLOGY I						
	1	S	R	O/F	C				
Total hours: 30T 2 0	0	0	0	0	2				
	Nil Co-requisite Nil								
0	=								
	Fall/ I semester of first year of the programme								
Course 1. To Understand and explain the processes of mitosis, meiosis, and the eukaryo					cell				
Objectives cycle, highlighting their roles in cellular division and	-		_		1				
2. To Investigate and compare the mechanisms of gen	_		_	•					
eukaryotic cells, focusing on molecular pathways an function.	ia tilei	n mpne	auons	ioi cei	Tutai				
	inclu	ding cell	prolife	ration	cell				
	alyze the molecular basis of cellular processes, including cell proliferation, cell and the role of cell-cell adhesion and the extracellular matrix in the evolution of								
multicellular organisms.	Ciruia	muunx	iii tiic c	Volution	511 01				
CO1 Describe mitosis, meiosis and eukaryotic cell cycle.									
CO2 Explain the processes of gene regulation in prokaryotic	and e	ukarvoti	c celle						
CO3 Describe the molecular basis of cellular processes and t					cell				
proliferation and cell death.	the m	cenamsn	iis tiiat	govern	CCII				
CO4 Explain cell-cell adhesion and the extracellular matrix	in the	evolutio	on of m	ulticel	lular				
organisms.									
CO5 Describe cell progression and death.									
Unit- Content Contact Learning Out	come				KL				
No. Hour									
I Cell division and cell cycle Learners would	Learners would be able to understand								
Mitosis and meiosis, their how cell undergonal to the control of the con	how cell undergoes division and								
regulation 7 regulation					1,2				
Steps in cell cycle									
Control of cell cycle									
II Gene Expression The learners with	The learners will become be able to								
	draw parallels between gene								
Transcription and translation expression in p	orokar	yotic and	l						
levels eukaryotic									
• Regulation of phages, viruses,					1,2				
prokaryotic and eukaryotic gene									
expression									
Role of chromatin in regulating Role of chromatin and care									
gene expression and gene silencing									
III Cellular Communication Learners will b	ne ahle	to unde	rstand						
General principles of cellular inherited genet									
communication associated to go			- ~						
Cell adhesion and roles of									
different adhesion molecules 10					1,2				
Gap junctions, extra cellular					-				
matrix, integrins,									
neurotransmission and its									
regulation.									

	Biology of Cancer		Students would learn the importance of	
	Normal and cancer cells,		cell-cell adhesion and the extracellular	
	Cell transformation		matrix in the evolution of multicellular	
IV	DNA and tumour viruses	8	organisms.	
	• Chromosomal basis of human	o		1,2
	cancer			
	Regulation of cell cycle in			
	cancer progression			
	Cell Proliferation and Death		Students would learn how cell	
	Factors for cell proliferation		undergoes progression and death	
\mathbf{V}	• Different types of cell death	10		1,2
	(apoptosis, necrosis and			
	autophagy)			

- 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: https://nptel.ac.in/courses/102/106/102106025/
- 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			

			SEME	STER – IV	V						
Course Ti	tle		MOLE	CULAR C	ELL BIO	OLOG	Y II				
Course co	de	23MSZO223R	Total credits:	4	L	T	P	S	R	O/F	C
			Total hours:		3	0	2	0	0	0	4
Pre-requis		Nil	Co-requ					Nil			
Programn	ne			OF SCIE							
Semester	v 1 G										
Course		1.To understand	•		•						s of
Objectives	5	eukaryotic cells, with a focus on cellular mechanisms and signaling pathways.									
		2.To Explore and apply techniques in cell and tissue culture, drug delivery systems, and									
		molecular biology, emphasizing their role in research and therapeutic applications.									
		3.To Investigate cell culture techniques, cancer therapies, and immunomodulation									
001			egies, with an emphasis on their molecular basis and clinical relevance. n processes at the molecular level for understanding functions of a eukaryotic cell.								
CO1		Outline the mole						ons o	ı a euk	aryotic	c ceii.
CO2		Apply technique				•	•	alivar			
CO3		Describe the tech				anu C	nug u	CHVCL	у.		
CO5		Explain cell cult				and ir	nmiin	omodi	ılatior	<u> </u>	
Unit-No.		Content		Contact				KL			
				Hour	Learning Outcome						
	Molec	cular mutagenesis		Learner	s wou	ld be a	ble to)			
	• Site	e directed mutager		understa	and ba	basic concepts DNA					
I	• Sec	Sequence tagged sites			interact	ion wi	th che	mical	agents	1,2	2
	• DN	IA microarrays									
	• hro	mosome painting									
	Cance	er genetics		To stud	y DNA	A inter	action	with			
	• Pro	genitor cells		chemical agents, cancer therapies and immunomodulation.							
		cogenes	10								
II		mour suppressor g						1,2	2		
		ir role in cancer									
		nes for apoptosis									
	-	rinsic and extrinsi			_						
Cell signaling pathw			S		Learner				with th	e	
		CR signalling		molecul	iar pati	nways					
***		APkinse	10						1.0		
III		ceptor tyrosine kir	iase (RTK)	10						1,2	2
		• JAK-STAT									
	• Ras										
) pathways	ar biology		Student	e will	ha fan	niliary	with		
	Techniques in molecular biology • c-DNA library										
		 C-DNA library Gene expression analysis (PCR, RT-PCR and DNA microarray), 			scientific competencies that will allow them to investigate the						
IV					molecul			_		nt 1,2	2
		LP, RAPD, AFLE	8	for the s				_			
		P. DNA Fingerpri		the livir	ng cell	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		1,2,3,4
Tactical	and denatured DNA	30		1,2,5,4
	• 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: https://nptel.ac.in/courses/102/106/102106025/

RELATIONSHIP BETWEEN COURSE OUTCOME(CO) AND PROGRAM OUTCOMES

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 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 15th and 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

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: 99

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 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
	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.

Breakdown of Credits

Sl.	Category		Total number of
No			Credits
1		Skill Enhancement Course (SEC)	-
		Ability Enhancement Course(AEC)	6
	University Core(UC)	Field Training	-
		Discipline Specific Elective (DSE)	-
		Value Added Course (VAC)	14
2	University Elective (UE)	Multidisciplinary Course (MDC)	-
	Offiversity Elective (OE)	Value Added Course (VAC)	-
3		Discipline Specific Core(DSC)	
	Program Core(PC)	Field Training	-
	Trogram Corc(TC)	Research /Industry Internship	27
		Summer Internship	-
4	Program Elective (PE)	Discipline Specific Elective (DSE)	20
	Trogram Elective (LE)	Value Added Course (VAC)	-
5	Faculty Core(FC)	Skill Enhancement Course (SEC)	5
	racuity Core(FC)	Ability Enhancement Course(AEC)	-
		Total	99

Breakdown by categories of Courses

Sl no	Category	Credits	%
1	Science	92	92.93%
3	Humanities and Management	7	7.07%
	Total	99	100%

SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course	Engagement								aximu arks f		
	D. 11.	Course Code	Course Title	Category	L	Т	P	S	R	0	С	IA*	SEE*	PE*	Total
	1.	23MSBT111R	Bioinstrumentation	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23MSBT112R	Biochemistry	DSC	3	0	2	0	0	0	4	40	60	100	200
Semester I	3	23MSBT113R	Cell biology	DSC	3	0	2	0	0	0	4	40	60	100	200
Sen	4	23MSBT114R	Microbiome and microbial techniques	DSC	3	0	2	0	0	0	4	40	60	100	200
	5	23UMFS111R	Fundamental of Statistics	Research	2	0	2	0	0	0	3	40	60	100	200
	6	23MSBT115R	Mini Research - R1	Research	0	0	0	4	6	0	2	0	0	100	100
	7	23UMPD111R	Effective English	AEC	0	0	4	0	0	0	2	0	0	100	100
	8	23MSCE111R	MOOCs-I	VAC	2	0	0	0	0	0	2	0	0	100	100
		T	otal								25				1300
				Course		Engagement					Maximum Marks for				
	S. N.	Course Code	Course Title	Category	L	Т	P	S	R	О	С		SEE*		Total
	1.	23MSBT121R	Immunology	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23MSBT122R	Molecular biology, genomics and genetic engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23MSBT123R	Bioinformatics	DSC	2	0	2	0	0	0	3	40	60	100	200
гП	4	23MSBT124R	Generic elective	VAC	2	0	0	0	0	0	2	40	60	0	100
Semester II	5	23MSBT125R	Techno-professional skill-I	SEC	0	0	4	0	0	0	2	0	0	100	100
	6	23MSCE121R	MOOCs-II	VAC	2	0	0	0	0	0	2	0	0	100	100
	7	23UMRM121R	Research methodology and Statistical Analysis	Research	1	0	4	0	0	0	2	40	60	100	200
	8	23MSBT127R	Mini Research (Research gap analysis- R2)	Research	0	0	0	4	6	0	2	0	0	100	100
	9	23UUHV101R	Universal Human Values	VAC	1	0	2	0	0	0	2	40	60	100	200
	10	23UMPD121R	Communication Mastery	AEC	0	0	4	0	0	0	2	0	0	100	100
		Т	Cotal								25				1500

	S. N.	Course Code	Course Title	Course	Engagement				Maximum Marks for						
	5. N.	Course Code	Course Title	Category	L	Т	P	S	R	O	С	IA*	SEE*	PE*	Total
	1.	23MSBT215R	Techno-Professional Skills II	SEC	0	0	4	0	0	0	2	0	0	100	100
	2	23MSCE211R	MOOCS-III	VAC	2	0	0	0	0	0	2	0	0	100	100
	3	23MSCE212R	MOOCS-IV	VAC	2	0	0	0	0	0	2	0	0	100	100
	4	23MSBT216R	Generic elective	VAC	2	0	0	0	0	0	2	0	0	100	100
	5	23UMRE211R	Research Ethics	Research	0	0	0	4	0	0	1	50	0	50	100
	6	23UMPD211R	Corporate Competency	AEC	0	0	4	0	0	0	2	50	0	50	100
Semester III	7	23MSBT215R	R3	Research	0	0	6	4	0	0	4	0	0	100	100
	8	23UUFL202R	Personal Financial Planning	SEC	0	0	2	0	0	0	1	0	0	100	100
			Discipline specific	elective (D	SE):	Stud	lent l	has t	o tak	e any	thre	ee			
	9	23MSBT211R	Plant and Animal Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	10	23MSBT212R	Medical Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	11	23MSBT213R	Bioprocess and Fermentation Technology	DSE	3	0	2	0	0	0	4	40	60	100	200
	12	23MSBT214R	Food Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
		7	Total								28				1400
				Course	Engagement			laximu larks f							
	S. N.	Course Code	Course Title	Category	L	Т	P	S	R	o	С		SEE*		Total
\	1	23MSBT224R	Research/data analysis/documentation- R4)	Research	0	0	20	8	6	0	13	0	0	100	100
ter I			Discipline specific el	ective (DSF	E):: S	tude	nt ha	as to	take	any t	wo				
Semester IV	2	23MSBT221R	Organic farming	DSE	3	0	2	0	0	0	4	40	60	100	200
	3	23MSBT223R	Agriculture Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
	4	23MSBT222R	Environmental Biotechnology	DSE	3	0	2	0	0	0	4	40	60	100	200
		7	Total								21				500

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

		SEMESTE	R – I							
Course Title Bioinstrumentation Course code 23MSBT111R Total credits: 4 L T P S R O/F C										
Course code	23MSBT111R		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			
Programme		Master of Scientific Master of								
Semester		Fall/ I semester of f								
Course	_	edge about the working of		Biome	edical I	nstrum	nents.			
Objectives		rinciple of different instrum le of chromatography, cent		,						
	• 1	raphy techniques including			fication	n princ	inles.	operation	. analysis	
(())	and application.	rapity teeminques meraumg	, 1115001) ,	Classi	ii c atioi	, princ	тртев,	operation	i, anarysis	
		on techniques, classificatio	n, princip	oles, o	peratio	n and i	its appl	ication.		
	Explain and investi	gate Electrophoresis, its car	tegorizati	on, ur	derlyir	ng prin	ciple, o	peration	al	
		functionality, dialysis, and								
(()4	_	e dating principles, includi	ng detect	ion, n	neasure	ment, i	isotope	s, radiati	on, units	
	and decay.									
CO5	Develop the comprehensive understanding of principles, and practical application skills in various									
Unit-No.	1	ods for scientific analysis. Content	СН	1	Loor	nina (Outco	mo	KL	
UIIIt-NO.		: History; Classification;	10	Abl	e to des				KL	
	" "	operation, application &	10							
_		Types, principles, operation, application & explain the chromatography and analysis (Paper, Column, Adsorption their applications				prij unu	1.0			
I		Thin layer, Ion exchange,						1,2		
	quantitative Ion ex	=								
	Chromatography):									
TT	_	Types; Application;	5		e to des			ite and	1.2	
II	Principle; rotors; of analytical centrifu			exp	lain the	centri	fuge		1,2	
	-	sis: Application; Types;	8	Abl	e to des	cribe	illustra	ite and		
	_	er (Principle); Dialysis,								
III		e: Southern, Western, &		explain the electrophoresis				1,2		
	Northern blot									
	Radio- isotope da	· .	7	1	e to des					
IV	Introduction, natur			expl	lain the	radio	isotope	es.	1,2	
		idioactivity, radioisotopes								
		radioactive decay. hniques: Introduction,	10	A bl	e to des	ariba	illustra	oto and		
V		ication of spectroscopy	10						1,2	
Practical		ecules from given sample	30	explain the spectroscope 30 Able to use various instruments						
	by				analysis					
	1. Paper chromato	ography								
	2. Column chrom								1,2,3,4	
	3. Thin layer chro									
		NA and protein molecules								
	by gel electrophor	esis								

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		Biocl	nemistry									
Course code	23MSBT112R	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			1	Nil	•					
Programmes		Master of Science	ce in Bio	techn	ology							
Semester		Fall/I Semester of Fi	rst Year	of the	e Prog	ram						
	1. To study the structure of biomolecules, such as proteins, nucleic acids, carbohydrates and lipids											
Course	2. To know the functions and interactions of biomolecules, which will provide the knowledge of											
objectives	the structure of cells and the various functions performed by them which are associated with life?											
		abolic pathways of biomolecu										
CO1	Improve the concept of chemical interactions and molecular organization of micro and											
CO2	macromolecules Understand the composition, structure and function of the biomolecules											
CO2		tanding on metabolism and p										
CO3		ets of secondary metabolites f										
CO4		understanding courses such				nd 2211	ulan fin	n ati anin	- at			
CO5	Prepare the base for molecular level.	understanding courses such	as motecu	1ar 010	nogy a	na cell	uiar IU	ncuonin	ig at			
Unit-No.		Content	СН		Lear	ning (Dutcoi	me	KL			
C.110 1 100		olecules (composition,	10	K	Learning Outcome Knowledge on the concept				1,2			
	_	ctions): Carbohydrates,	10		of biomolecules,				-,-			
	Proteins, Lipids, N		di	fferenti	iating t	he vari	ious					
I	and Minerals.		bi	omolec	ules w	ith tho	rough					
		understanding on their types and functions				•						
			ty	pes and	l funct	ions						
	Bioenergetics: Co	encept of thermodynamics	10	D	emonst	rate th	e.					
	_	and free energy), reaction	10		fundamental knowledge of							
	kinetics: Substrate			oenerg			- 1	1,2				
	oxidative phospho	rylation, Enzymology:			ıd its ki							
II		sis, enzyme and enzyme			nderstai	_						
	-	egulation, mechanism of			etaboli			- 1				
		Importance of enzymes in		-	plication		clinical	l and				
	diagnosis and there	apy.		th	erapeut	ics.						
	Metabolism of bio	omolecules:	10	В	uild kn	owleds	ge of th	ie	1,2			
		etabolism: Glycolysis and			ochemi				,_			
	its regulation, Glu			1 -	nthesis		-	I				
III	Glycogenolysis TO	-			the car	-		I				
		y, glyoxalate pathway.			oids wi	th its re	egulato	ry				
	_	: oxidation of saturated		cc	ncept							
		tty acid, odd chain fatty fatty acid metabolism.										
	_	bolism: Transamination,	8	II	ndersta	ndthe s	amino	acid	1 2 3			
		ts types, urea cycle	0		ndersta nd nucle				1,2,3			
137		olism: biosynthesis and			id degr		•	I				
IV		ines and pyrimidines			ochemi			I				
				cc	ncept							
	Heme Metabolism	n and Photosynthesis and	7	L	earn the	e synth	esis an	d	1,2,3			
	Secondary metab		·		eakdov	-			4			
\mathbf{V}	Heme synthesis an				nowled		_					
•	-	ructure of chloroplast,			echanis							
	_	dark reaction, Brief			notosyn							
	concept on the sec	ondary metabolites		th	e conce	ept of s	econda	ary				

	(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: https://pubmed.ncbi.nlm.nih.gov/34809432/

	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.

		SEMESTER -I											
Course Title		Cell B	iology										
Course code	23MSBT113R	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				Ni	l						
programme		Bachelor of Science	in Bio	tecl	nolog	y							
Semester		Fall/ I semester of first	year of	the	prog	ramm	e						
		idents understand the structures and purposes of basic components of											
Course	1 *	and eukaryotic cells, especial	-						_				
Objectives		ow the cellular components an		_				ergy ir	cell	S			
CO1		the cellular components unde					1.						
CO1	_	ing on the membrane structure											
CO2	1 *	ing on structural organization			ts orga	nelles.							
CO3		understand the process of cel			• ,		,						
CO4		he how the cell communicates			_		1.						
CO5	_	understanding advance course		olog									
Unit-No.		Content	СН			ning (k	KL_			
I		are and Function: (Structure				dge of							
		ane, lipid bilayer and			of cell membrane and								
	1	diffusion, osmosis, ion ansport, membrane pumps,	7	1	unction	1			1.2				
	1	ing and regulation of	7		'		′					1,2	
		oort, electrical properties of											
	membranes)	ori, electrical properties of											
II		ation and function of		7	To learn the basic								
	_	elles (Cell wall, nucleus,		s	structural organisation of		n of						
	mitochondria, Gol	gi bodies, lysosomes,	10	i	ntracel	lular or	ganell	es	1,	2			
	_	ılum, peroxisomes, plastids,	10						1,	_			
	_	ast, structure and function of											
	cytoskeleton and i	* *		4_									
III		Cell Cycle (Mitosis and				erstand							
	_	llation, steps in cell cycle,	10	of how a cell divides and its importance in cell					1,	2			
	regulation and con	aroi oi ceii cycle)			ıs impe cycle.	rtance	in cen						
IV	Cell signalling: (L.	igands and their receptors,			_	w abou	the						
Ι. Υ	_ ,	or, signalling through G-				nication							
	_	ceptors, signal transduction				ng mec		ns in					
		messengers, regulation of	0	- 1	ells				1 '	า			
	signalling pathway	s, bacterial and plant two-	8						1,	۷			
	1 *	s, light signalling pathways											
	_	chemotaxis and quorum											
		smission and its regulation				_							
V	1	cation: (Regulation of		- 1		dge on							
		eneral principles of cell	10	- 1	egulato ell	ory med	hanisi	ns of	1 '	า			
		ell adhesion and roles of molecules, gap junctions,	10	'	JE11				1,	۷			
	extracellular matri												
Practical		icroscopic observation of		I	Describ	e, illus	rate a	nd					
i i acticai	_	of Mitosis of given				and ap							
	sample(s).	Č	20		staining techniques and		122	721					
		nd microscopic observation	30		_	ıt micro	-		1,	1,2,3,4			
	_	es in Meiosis of given		6	examin	ation.							
	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.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											
Course Title		Microbiome and Mic	crob	ial Te	chnique	S							
Course code	23MSBT114R	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											
Semester		Fall/I Semester of First Y		of the	Progra	mme							
	1. Introduction to Basic Microbiology and microbiome.												
C	_		tical thinking and problem-solving skills through the use of case studi										
		nd reviews of scientific literature.											
objectives	3.To discuss the historical perspectives important in the development of microbiology along with												
	the current diversity in the field. 4.To discuss and perform the various techniques associated with microbiology												
CO1		of the field and focus on prok					nction	S					
CO2	=	r culturing microorganisms.	uryo		Structure	una ra	netion						
CO2	Elaborate the approach												
CO4		roorganisms in the field of E	nvir	nment									
CO4	Describe diversity of m	=	AIIVIIC	липен	•								
Unit-No.	Describe diversity of it.	Content		СН	Laam)4aa		KL				
UIIII-INO.	M: 1: C	t of Microorganism & struct		Сп	Lear				KL				
I	and types, Gram posi Actinomycetes, Intro fungi, molds and year Fungus, Major polyst cell wall, Cell wall co microbial secondary Probiotics. Physical and chemica Sterilization by dry h agents- Alcohol, Ethy Aldehyde, Formaldel bacteriostatic. Effect technique: Gram stair	aryotic cell, Bacterial Structustive and Gram-negative bact duction to characteristics 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, yde, Bacteriocidal, of dyes, Gases. Staining ming, Aerobic and anaerobic e and pure culture. Technique	eria, agal at of	7	Knowle chemics sterilizatechniq staining preserv	egative bacte ction to wall co edge or al tech ation, i ue and	ce bety e and g ria, o fung ompon n phys niques solatic media	i and leents ical, s of on, a and	1,2				
II	of pure culture isolati Spread plate methods & nutrient broth, type types of media, transpletechnique, Colony For calculation, Preservat culture Culture-dependent ap	ion: Streak plate, Pour plate, s. Definition of media, Pepto es of media, uses of different port media, Serial dilution orming Units (CFU) and it's tion and maintenance of pure opproaches for microbial divernitations, Exploration of	ne,	10	Knowledge on		Knowledge on difference between					1,2	
Ш	Unculturable bacteria methods studying of knowledge about bac genome concept. Mic	a: Culture independent molecunculturablebacteria, expand terial growth requirements, 1	l the met-	10	culture dependent and culture independent molecular methods, Bacterial growth requirement.				1,2				
IV		z its role, normal microflora l tract. Human microbiome &		8 Knowledge on different types of microbial flora present on different parts of body				lora	1,2				

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	 Laboratory Safety, preparation for experiment, and laboratory waste management. Principle, operation and measurement of pH of a given sample Principle and operation of Hot air oven, Autoclave, Laminar airflow and centrifuge. Isolation of microbes from given sample by serial dilution techniques and estimation of the CFU (Pour plate and streak plate techniques also be learned) Staining (gram, acid fast, endospore or any appropriate staining) of the given microbial sample and observation under microscope. 	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 -]	[
Course Title		Fundamenta	l of S	tatist	tics				
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			
Programmes		Master of Science	in Bi	iotec	hnology	y			
Semester		Fall/I Semester of First	Year	of th	e Prog	ramme)		
Course objectives	research 2. Introduce stumedian, mod 3. Teach studen graphs	erstand the role of statistics in adents to descriptive statistics de) and measures of dispersion and the summarize and pre-	, inclu n (rang esent d	iding ge, va lata el	measure riance, s	s of cer	itral ter	ndency (n	nean,
		ng of Descriptive Statistics an							
		o understand the Probability t							
		o understand the methods for	• •						ysis.
CO4	Develop knowledge t	o understand the principles of	vario	us sta	itistical a	analyses	of dat	a.	
CO5	Develop knowledge o	on R language for data analys	is						
Unit-No.		Content	C	Н	L	earnin	g Out	come	KI
I	Statistics, concepts o sample. Data: quanti	E Definition and scope of if statistical population and tative and qualitative, scales of measurement erval and ratio.	:	5	Foundat of Stati	tional U stical C		_	1,2
II	histogram and ogives Tendency: mathemat of Dispersion: range	ar and graphical, including s. Measures of Central tical and positional. Measures quartile deviation, mean eviation, coefficient of and kurtosis.	·	5	Proficiency in Data Presentation and Analysis				1,2
III	Bivariate data : Defi simple, partial and m variables only), rank	inition, scatter diagram, nultiple correlation (3 correlation. Simple linear polynomials and exponential	:	5	Knowle Bivariat Relation	e Data	-	ing	1,2
IV	Random experiments sample space, event, concepts of mutually events. Definition of relative frequency appace, Properties of pevents, Conditional propound probability Distribution, Binominal properties of pevents, Conditional properties of permitted permitted properties of permitted properties of permitted properties of permitted	ot: trial, sample point and Operations of Events, exclusive and exhaustive probability: classical and oproach. Discrete probability probability, Independence of probability, total and ey rules, Normal probability al probability Distribution, Distribution, Bayes' theorem	8					pability	1,2
V	Testing of hypothes test, chi-square test.	is, parametric test: t-test, z- Non-Parametric test: One test, Wilcoxon Signed test, Kruskalwails test.		7	Applica Testing				1,2
Practical	1.Introduction to R - and environment for Syntax of R expressi	A programming language data analysis and graphics. ons: Vectors and assignment, nerating regular sequence,	3	30	A brief fordata visualiz	analysis	_	using R	1,2, 3,4

r	· · · · · · · · · · · · · · · · · · ·	_
	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

		SEMEST	ER -	I														
Course Title	ourse Title MINI RESEARCH (REVIEW OF LITERATURE-R1)																	
Course code	23MSBT115R	Total credits: 2	L T P S R O/F C									L T P S R O/						C
		Total hours: 30P	0	0	0	4	6	0	2									
Pre-requisite	Nil	Co-requisite			•	Nil	ĺ											
Programmes		Master of S	cience	in Bio	technol	logy												
Semester		Fall/I Semester of	of First Year of the Programme															
Course		To develop stu	students scientific writing skill															
objectives		To develop stu	denis s	Clemmic	witting	SKIII												
CO1	Employ databases a	nd library resources to g	gather o	original 1	research	, books	, and a	rticles effe	ctively									
CO2	Summarize and diff	erentiate between vario	us type	s of revi	ews, spe	ecificall	y analy	tical and										
	descriptive reviews.																	
CO3	Identify research top	pics and employ approp	riate m	ethods f	or collec	cting an	d filter	ing inform	nation.									
CO4	Critically analyze th	e demonstrations and fi	indings of previous authors to comprehend their															
	contributions and in	sights.																
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										
Course Title	EFFE	CTIVE ENGLISH (Comn	nunica	ative En	glish	& Soft	Skills)		
Course code	23UMPD111R	Total credits: 2	L	T	P	S	R	O/F	С	
		Total hours: 60P	0	0	4	0	0	0	2	
Pre-requisite	Nil	Co-requisite				Ni	l			
Programmes		Master of S	cience	in Bi	otechno	logy				
Semester	5 9.									
Course objectives 1. To introduce the types of sentences and their significance. 2. To strengthen the students' vocabulary to enhance their speaking. 3. To familiarize the students with the importance of dress codes. 4. To introduce the 3P's (Planning, prioritizing & performing) of To give insight into English pronunciation and into central control of the students.						eaking odes ir of Tir d conce	various ne Mana epts in p	s organization rgement. Supplies thonetics.	ons.	
CO1		ble students to analysis								
CO2		e to integrate the skills of		_	-	_	fessiona	al communic	cation.	
CO3		e sessions will boost the								
CO4		about the effective and o								
CO5	Introduction to Pho	netics and its importanc	e will i	mprov	e the lear	ners 'p	ronunci	ation		
Sl No		Content				Lear	ning O	utcome		
	Module 1- Grammar Interchange of Interrogative and Assertive Sentences, Exclamatory and Assertive Sentences, Types of Tenses, Common Errors, Synonyms, Antonyms, Homonyms Module 2- Reading Skills Techniques of Effective Reading, gathering ideas and information from a text The SQ3R Technique Interpret the text			ve o s g for D and w th	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					
MODULES	that adversely affect Listening and Hearing Effective Listening. Process, Module 4- Conflict Definition, Type of	The Process of Listening t Listening, Difference l ing, Purpose and Import How to Improve Lister	etween ance of ning	rrs a h h p p l L of c c licts p	positive environment by turning					
	Importance of Time Maintain Time.	ne Management, Purpos Management, Basic Ti	ps to	E n a u n	Enhance productivity and stress management through effective time allocation and planning. It helps to understand the importance of time management in achieving personal professional goals.					
	be given to the stud	solving activity: A situates and they will have ituation or solve the pro	to tell ι	on will tell us						

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					

	SEMESTER - II									
Course Title Immunology Course and 23MSMP121D Total gradity 4 I T D S D OU										
Course code	23MSMB121R Total credits: 4 L T P S R O/F									
		Total hours: 45T+301	P 3	0	2	0	0	0	4	
Pre-requisite	Nil	Co-requisite				Nil				
Programmes		Master of Scien	ce in B	iotechr	ology				-	
Semester	S	pring/II Semester of F	irst Ye	ar of th	ne Pros	gramı	ne			
		ts understand the Immune				_		respons	e,	
Course		ly, immunity, Hypersensiti						_		
objectives	2. To make studen	ts learn various immunolo	gical co	ncepts.						
		students in diagnostic tecl	_							
CO1	Describe the immune	system and its components	s and th	eir mode	e of acti	ion in o	defense	mechar	isms.	
CO2	Outline antigen and a	ntibody structure, types, an	d prope	rties inc	luding	the pro	cesses	of mono	oclonal	
	and polyclonal antibo	•	1 1		8	1				
		of different immunologica	l diagno	ostics tes	sts, thei	r princ	iple, ar	nd		
	1	in the detection of the und	_			•	•			
		on and cancer immunology					earch.			
		al disorders like autoimmu		_				ention		
	strategies, and manag		-			-	-			
Unit-No.	Co	ontent	СН		Learn	ing O	utcon	ne	KL	
I	Introduction to im	munology –		Kno	wledge	of Im	mune s	ystem,		
	Definition, history,	scope of immunology.		Imn	nunity,	immun	e respo	onse		
		mune system-cells and								
	organs of the immu	-							1,2	
	response- Humoral		,						1,2	
	immune response. I									
		nd acquired immunity,								
	APC.									
II	Antigens – General				wledge		_			
		Antibody – Structure, iated effector functions			r proper their ty					
	– opsonisation, antib				-	-	_			
	complement, ADCC	•		production and purification process						
	idiotypes,	, isotypes, anotypes,								
	I	on and purification –	10							
	production of mono	-								
	immunotoxins, abzy									
	_	ion of immunoglobulin								
	genes- antibody div	ersity, class switching								
	of Immunoglobulin									
III		interaction – principle			oretical	-				
		IA, ELISA, Western			wledge			and		
	blotting, Immunoflu		10		ess of				1,2	
	Complement system			imn	nunolog	ncal di	agnosti	ic tests		
	alternative pathway			17	1 .		1			
IV	HLA – Theories of	-			wledge		_			
	HLA typing, MHC,	-			nunolog ctors.	y and	ımmun	e		
	Transplantation imm rejection, immune su			ene	CIOIS.					
	-	linical transplantation	8						1,2	
	Immune tolerance, c	=	ø						1,2	
		ated cytotoxicity, NK								
	cells, TNF, Interfere	-								
	leukocyte activation									
	15 mile by to don't dillor	-,								

V	Hypersensitivity and types, Autoimmunity, Cancer and immune system – tumour antigen, tumour evasion and immunotherapy of cancer, AIDS – primary	10	Knowledge on Hypersensitivity, Autoimmunity, cancer immunology, immunodeficiency and vaccines	1,2
	and secondary immunodeficiency. Vaccines and its types			
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:

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					

		SEMESTER - I								
Course Title	MOLECU	LAR BIOLOGY,GENOMI	CS A	AND	GENE	TIC	ENG	INEERI	NG	
Course code	23MSBT122R	Total credits: 4	L	T	P	S	R	O/F		С
		Total hours: 45T+30P	3	0	2	0	0	0	4	4
Pre-requisite	Nil	Co-requisite					Nil			
Programmes		Master of Science								
Semester		Spring/II Semester of Fir	st Ye	ear of	f the P	rogra	mme			
Course objectives	2. To teach transcript point pres	 To teach in depth about genome and its arrangement in eukaryotes and microbes. To teach the central dogma of life (replication, transcription, translation and post transcriptional modifications) with the best possible teaching tools (explanation/power point presentation/seminar/assignment) and with utmost attention. 								
CO1	Explain the fundar the central dogma.	nental of genomics concepts such	ch as	genoi	ne, DN	A stru	cture,	RNA, pro	teins	and
CO2		ds for mapping genomes, descri	be ma	arkers	s. linkag	e anal	vsis w	ith differ	ent tv	nes
C 0 2	_	sical mapping, and basics of ger			_		-		5	1 -5
CO3		tic and eukaryotic genomes, inc							nal Di	NA
-		ital function of DNA binding pr								
CO4		nics of genome access, encomp								
	heterochromatin, c	heterochromatin, chromosome painting, nucleosome modifications, histone acetylation, DNA								
	modifications, DNA methylation-induced gene silencing, and gene regulation in both prokaryotes									
	and eukaryotes.									
CO5		on causes, types of DNA mutat			IA repa	ir mec	hanisn	ns, crucia	l for	
	maintaining geneti	c stability and impacting human	n heal	th.						
Unit-No.		Content		СН			_	itcome		KL
	_	enomics, definitions of genome,				-		vledge an	d	
I	DNA structure and composition, RNA and the			7		_	he exis	sting		1,2
•	transcriptome, proteins and the proteome, the				under	standi			-,-	
	central dogma									
		mes, markers for genetic			_	_		iques in		
***		is to genetic mapping, linkage erent types of organisms,		1.0			ved by	linkage		1 0
II	"	- 1	10	mapp	ıng				1,2	
	physical mapping									
	shotgun sequenci				I/	1.1	DN	· A		
	_	aryotes and eukaryotes, extra IA, role of DNA binding			Know			A aryotes ar	,d	
	proteins in genon			eukary				ıu		
III	studying DNA bi		10	-		_	oteins and	4	1,2	
111	1	special features of DNA		_		isis on ies inv	_	otems an	•	1,2
		interaction between DNA and			CIIZYII		,			
	its binding protein									
		nome: euchromatin and			Geno	me or	ganisat	tion is	+	
		chromosome painting,					ı detail			
	nucleosome mod	ifications and genome			vario	us pos	t transl	lational		
IV	expression, histor	ne modification, acetylation,	8	8	event	s alon	g with	regulator	y	1,2
	DNA modification	ons and genome expression,			mech	anism	S			
		DNA methylation, gene								
		caryotes and eukaryotes								
_	_	enetic engineering, Different		_	-			course,		-
	_	ng enzymes, methods for			studen					
	_	ectors for bacteria, plant and		1.0	geneti	_		_		
\mathbf{V}	_	on vectors, DNA libraries,		10	techni	-				1,2
	application of gen	netic engineering.				_		n vectors,		
					and pr	_		ative		
					applic	ations				

	Isolation of genomic DNA., Isolation of plasmid	30	Knowledge on extraction of	
	DNA, Polymerase chain reaction, Endonuclease		DNA and plasmid from	
Duastical	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, 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, 4				
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				
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				
5	Discuss thegenetic engineering techniques, including DNA manipulation, vector use, and DNA libraries, and explore their applications.	1, 2, 7				

		SEMESTER -	· II								
Course Tit	le	Bioinf		ics							
Course code	e 23MSBT123R	Total credits: 3	L	T	P	S	R	O/F	С		
		Total hours: 30T+30P	2	0	2	0	0	0	3		
Pre-	Nil	Co-requisite		U		Nil		U			
requisite	1111	Corequisite				. 122					
Programme	s	Master of Scienc	e in Bi	otechn	ology						
Semester		Spring/II Semester of Fir				ramı	me				
	1. To search	and retrieve biological information						bases.			
Course objectives		ge on computational database n	_	-	tem an	d its a	pplicat	tion in l	Biology		
	5. A basic i	dea on the structural biology us									
CO1		n Bioinformatics and its signific					al data	analys	is		
CO2	_	abase management system and									
CO3		e on sequence submission tools	as well	as biolo	gical s	earch	engine	es			
CO4		uence alignment and analysis.									
CO5	Learn the concept	of computer aided drug designi	ng								
								Т			
Unit-No.	Content			СН			Outc	ome	KL		
I		informatics, Scope and Applica		7	Knov	_	on tics an	1 '4			
	· ·	introduction to various molecular Importance of Computers/IT in			relati			a us			
		atfileformats. Biological Databa					niology	v and			
		eral Introduction of Biological			its ap			,	1.2		
		ide sequence databases (NCBI,				-			1,2		
		. Protein sequence databases									
		R, GenPept), Specialized Genor	ne								
		IGR etc). Structure databases									
II	•	1 PDB, NDB, MMDB) nent System: Basic Concept of		6	Forn	nation	ofn				
11	_	of Entities, Attribute, Keys,		0			nd its				
		e level architecture of a DBMS,	,			cation					
	Structure of a DBN	AS, Advantages & Disadvantag	es of		biolo				1,2		
	a DBMS.File Base										
		rchical, Network, Relational Da	ata								
TIT	Model etc	(1	1	7	IZ.	1 1					
III		tabase search engines: Text-bas trez, DBGET /Link DB). Seque		7	diffe	wledg rent	e on				
	• ,	arch engines (BLAST and FAS				iform:	atics				
	•	engines (ScanProsite and):				ines ar	nd	1,2		
	eMOTIF). Structur	e similarity-based search engin	es		their	appli	cations	s in			
		tension, VAST and DALI).			retrie	eving	data				
		ExPASy server, EMBOSS.			<u> </u>	2.7					
IV	•	alignments: Sequence similarity		5	_		owled	ge			
	•	ogy. Global and local alignmen ast, Application of Blast tool,	ι,			equen	ce and its	,	1,2		
		ast, Application of Blast tool, alignments and Application of				icatio		,	1,4		
	multiple sequence a				1.1.						
V		drug design- concept, methods	and	5	A br	ief kn	owledg	ge			
		es, various computational metho	ods		on d	rug de	signin	g			
		he drugs, CADD software				-	mpute		1,2		
	demonstration. Pro	tein homology modeling				_	otein 3	ט			
	Data rational for	different high sign 1-4-1-		20		elling					
Practical	Data retrieval from	different biological database		30	Knov	rieage	on		1,2,3,4		

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					

		SEMES	STER -	II						
Course Title	Co.	ncepts of Orga	nic Cu	ltivat	ion (G	eneric	Electi	ive)		
Course code	23MSBT124R	Total credits: 2	2	L	T	P	S	R	O/F	C
	•	Total hours: 30	T0	2	0	0	0	0	0	2
Pre-requisite	Nil	Co-requis	ite				Nil	•	•	•
Programme	Offered	l by Program	of Biot	techno	logy fo	or stud	dents o	of othe	er	
		1	Faculty of Studies							
Semester	Fall/Spring/II,	IV(UG)/II, III	(PG) S	Semes	ters ot	her th	an Fa	culty o	f Scie	nce
	1. Introduction to Co	oncept of Organi	c cultiva	ation						
Course	2. To discuss the Or	-	-		_					
objectives	3. To discuss the me	thods associated	l with or	ganic 1	farming	– mulc	ching, c	rop rot	ation, t	illage,
	bio-fertilizer etc.									
CO1	Explain the OF, its prin									
CO2	Discuss the relation bet		-				•			
CO3	Explain cultural, mecha		gical met	thods f	or crop	protect	ion and	l mana	ge orga	nic
	production for various of	*								
CO4	Illustrate crop protection	_	uding bi	opestic	ides an	d orgar	nic met	hods fo	r key c	rops, and
	understand yolk functio									
CO5	Discuss the soil less far	ming system.								
Unit-No.	Content		C]			Learr	_			KL
I	Introduction to Organ	-	7	1		derstan				
	(OF); Development of					types, p	_	les, ben	efits	
	Principles and Types of				and	l scope	•			1.0
	Biodynamic Farming;									1,2
	Benefits of OF; Conve Farming (CF) Vs (OF)									
	OF.	, scope of								
II	OF System; Soil and S	Soil tillage	8	!	De	scribe i	llustrat	e and		
11	Choice of crop/ varieti	-	O			olain th			ning	
	Propagation – Seed, p				1 -	tem	018			
	material and seed treat	_								
	Crop rotation, Intercro									1,2
	Water Management, C	reen								ŕ
	Manuring, Mulching,									
	Composting, Vermico	mposting,								
	Organic Manure, Biof	ertilizer								
III	Crop Protection: Cul		5			scribe a	-			
	Mechanical method; B	-				ious w	ays for	protect	ting	
	and Botanical Pesticid	es, Bio-			pla	nts				1,2
	control agents, Weed									
***	Management			,			1	1 1 1		
IV	Organic crop produc		5			scribe a				
	Rice, Zinzer, Turmeric				1 -	ganic pr	oauctio	on of C1	op	1,2
	and Vegetables Yolk-i and significances	ts function			pla	1115				
V	Concept on modern of	rganic	5	,	De	scribe a	and exr	lain th	e	
•	farming methods – H	_	3			dern m				1,2
	Aquaponics, Hydropon					icultur				1,2
<u> </u>	1 I quaponico, il yuropo				ugi		-			

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						
Course Title		Techno Pr	ofessi	onal Sl	tills - I				
Course code	23MSBT125R	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	ı		I
Programme		Master of Sci	ence i	n Biote	chnolo	gy			
Semester		Spring/II semester o	f first	year of	the pr	ogram	me		
Course objectives	2. To enable 3. To make	p proficiency in different students to interpret morp skilled students in microbi chromosomes in Drosophil	hologi ologica	es of mi	croorgan olecular	isms ar biology	d chro	mosomes	•
		grasshopper testis or onic				•			
CO2		aining techniques for micr			rstand co	en aivis	10n.		
CO3				iaiysis.					
CO4	11.	s for bacterial differentiation		1	4 1.	41	1 C	. 1	.1
CO5	culture.	nduct agarose gel electrop	noresis	, and us	e streaki	ng meti	10as 10	r microbi	aı
Unit-No.	curture.	Content		C	H I	earnir	ng Out	come	KL
I	2. Study of m flower bud 3. Staining tec	chniques: cle stain stain fast stain ive staining treaking methods for pure	culture	3(U	nderstai organi		cellular 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												
Course Title	Course Title MINI RESEARCH (REVIEW OF LITERATURE-R2)												
Course code	23MSBT127R	Total credits: 2	L T P S R O/F C					L T		P	S	S	C
		Total hours: 30P	0	0	0	4	6	0	2				
Pre-requisite	Nil	Co-requisite			1	Nil		•					
Programmes		Master of Science	e in B	iotech	nolog	y							
Semester	r Spring/II Semester of First Year of the Programme												
Course	To develop students sci	scientific writing skill											
objectives													
CO1	Employ databases and l	ibrary resources to gather	origin	al resea	arch, bo	oks, an	d article	es effectiv	vely				
CO2	Summarize and differen	ntiate between various typ	es of re	eviews,	, specifi	cally a	nalytica	l and					
	descriptive reviews.												
CO3	Identify research topics	and employ appropriate r	nethod	s for co	ollecting	g and fi	ltering	informati	on.				
CO4	Critically analyze the d	emonstrations and finding	tions and findings of previous authors to comprehend their										
	contributions and insigl	nts.											
CO5	Compose a detailed rev	iew that explains the pros	pects a	nd futu	re direc	ctions o	f the ch	osen stuc	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	atist	ical A	nalysis	5			
Course code	23UMRM121R	Total credits: 2	L	T	P	S	R	O/F		C
		Total hours:15T+60S	1	0	0	4	0	0		2
Pre-requisite	Nil	Co-requisite				Nil		l		
programme		Master of Science	e in Bio	tech	nology	7				
Semester	5	Spring/II semester of Fir					ne			
		e aims to enhances the						ng of	rese	earcl
	methodolog	y, includingtheoryofscience	andqual	itativ	eandqu	antitati	vemetl	nodsini	esea	arch.
Course	2. The course	seeks to enhance the studen	ıts' skill	s for	develoj	oing cr	itical tl	ninking	g thr	ougl
objectives		erature review in different do			-			_	skil	ls fo
objectives		of a research proposal for a								
	_	Students competency in pl	lanning,	cond	ucting,	evalua	iting a	nd pre	sent	ing a
G01	research pro	=	.1 1							
CO1		asic knowledge of Research								
CO2		e knowledge of Research M								
CO3		to gain the Skill questionna								
CO4		to acquire the knowledge of	f basic I	Repor	t/disser	tation]	Proced	ure.		
CO5	Knowledge on differ		r							
Unit no		Content	СН		Learni		itcom	e	K	
I		ogy- An Introduction-	2		owledg				1,	,2
	meaning and object				damen		_	f		
		rch, types and significance			earch n					
	of research, criteria	rch Problems- definition			luding ectives		_	ına		
	_	n, necessity of defining		00)	ccuves	or resc	arcii			
	research problem	i, necessity of defining								
II	1	neaning and need of	4	Able	e to un	lerstan	d and		1.	,2
		ntures of a good design,		appl	ly the f	undam	ental			,
	different research d	esigns,		prin	ciples	of resea	ırch			
		steps in sampling design,			gn, inc	_				
	1 *	nination, criteria for			ining ai		ssity o	f		
	selecting a sampling	_		rese	arch de	sıgn				
		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 go	ood kn	owledg	e on		1.	,2
		tion, Nominal, ordinal,		_	erent ty	_		nd	•	
	interval and ratio			l	ntify va			and		
	– Attitude scale cor			tool	s for da	ta coll	ection			
	measurement, ratin	_								
		se of scale in statistical								
	•	for interviews preparation, development of survey								
	instruments and ite	_								
	questionnaire									
IV		izing research report,	3	Able	e to org	anize a	and wri	ite a	1	,2
- ·		report, Different steps of			prehen				1	,_
	writing report,	<u> </u>		repo	_					
	lay out of the resear	rch report, How to								
	_	sertation, mechanics of								
	writing research rep	port, 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			
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			
Tractical	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						

	I	SEMESTER -							
Course Title		JMAN VALUES (UHV		,	,				
Course code	23UUHV101R	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		er of First year of the p							
Course objectives	'SKILLS' to all human b 2. To facilitate profession a of the Hum of Universa 3. To highligh human cond interaction	e the development of a Holias well as towards happines an reality and the rest of Extl. Human Values and move t plausible implications of duct, trustful and mutually with Nature	stic pe stic pe s and j istenc ment to such a	erspecti prosper e. Such owards Holisti ng hum	ve amor ity base a holist value-b c unders an beha	ng stude d on a c ic persp ased liv standing	ents toverest to ective ving in g in term	aspirati vards life understa forms th a natura ms of eth ually em	ons of e and ending ne basis I way hical riching
CO1		this course is explorational			-	•		nvolves	a
		nal study of the human bein		à-vis th	e rest of	existen	ice.		
CO2	-	ogma or value prescriptions							
CO3	-	-investigation and self-expl							
CO4	it in their own right,	s truth or reality is stated as based on their Natural Acc	eptanc	e and s	ubseque	nt Expe	erientia	l Valida	tion.
CO5	1 *	exploration takes the form on to continue within the st		-					udents
Unit		Co	onten	t					
	Self-Explor Experientia Continuous Right under fulfilment of Understand currentscen	fulfil the above human aspir	nt and ism for A loo Physican bein ty con	proces or self-e k at bas cal Fac ng with rectly-	s; 'Natu explorati sic Hum ilities- tl their co A critica	ral Accon an Aspi ne basic rrect pr al appra	rations requir iority isal of	e' and ements	for
II	 Understan Understan Understan Understan correctapp Programs 	dinghumanbeingasaco-exist ding the needs of Self ('I') ding the Body as an instrurt ding the characteristics and ding the harmony of I with braisal of Physical needs, musto ensure Sanyamand Swasten up in PracticeSessions.	and 'Enent of activithe Boaning	Body' - f 'I' (I b ties of ' ody: Sa g of Pro	Sukhand being the I' and hand hand nyamand sperity i	d <i>Suvidh</i> e doer, s narmony d <i>Swast</i> n detail	a seer and in'I' hya;	d enjoye	r)
III	Understanding value fulfilment to ensure Trust (Vishwas) and Understanding the Difference between Understanding the Between respect and Understanding the	mony in the family – the bases in human-human relation to be Ubhay-tripti; de Respect (Samman) as the meaning of Vishwas; a intention and competence meaning of Samman, Differed differentiation; the other tharmony in the society (sociah-astitva as comprehensive	nship; found rence salient	meanin ational t values eing an	values of Ny values of in relate extension	vaya and of relati	d 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.
20010110	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
	1 A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

ii) What is Naturally Acceptable to you – to nurture or to exploit others? Is your living the same as your natural acceptance or different?

What is Naturally Acceptable to you in relationship-Feeling of respect or disrespect?

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:

- 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	CO	OMMUNICATI	ON MASTERY (Co	mmun	icativ	e Eng	lish &	& Sof	ft Skil	ls)
Course code	23UM	PD121R	Total credits: 2	L	T	P	S	R	O/F	C
			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 o	of the	progr	amm	e		
	1.	1. To familiarize students with the transformation of sentences and the appropriate use of							use of	
		prepositions.								
Course	2.									
objectives	3.		ng by reinforcing, subst	ituting	foror (contrad	ictingv	/erba	l	
		communication.	C 1 4		C	· ·	1	1	1 .	4
CO1	4.		performance boosting a questions, and idioms co			rotessic	mai go	oai ac	nieven	ient.
	_		ent sentence types and							
CO2		<u> </u>	* *							
CO3	_		hs, precis, and profession							
CO4			goal setting, and person	, .	•	•	S.			
CO5	Illustrate	e non-verbal comn	nunication and body lan		concep	ts.				
Unit			Conte	ent						
35 13 4	I.	Use of Preposit	ions							
Module 1-		II. Tag questions								
Grammar		III. Idioms, Phrases and Clauses IV. Simple, complex, compound sentences								
Module 2-	IV.	Active and Pass	=							
	II.	Direct and Indire								
Grammar				1						
	I. II.	Paragraph Writi	riting; avoid ambiguity	and va	guene	SS				
Module 3-	III.	Precis Writing	ing							
Writing Skills	IV.	Letter Writing								
	V.	Resume, CV and	d Cover Letter							
Module 4-	I.	SWOT Analysi								
Self-	II.	Self-Regulation	ı- Goal Setting							
Management	III.	Personal Hygie	ne							
Skills										
	I.	What is Non-Ve	rbal Communication &	Body I	Langua	ige,				
Module 5-	II.	Elements of Cor	nmunication,		_	_				
Non- Verbal	III.	Types of Body I								
Communicati	IV. Importance and Impact of Body Language,									
on-Sciences of	V. Types of Communication through Body Language,									
Body	VI. Introduction to Haptic, Introduction to Kinesics									
Language	VII. VIII.	Introduction to I		t Claari	na Ca	agion				
Module 6-	VIII.	Importance,	Do's and Don'ts, Doub	n Cieari	ing se	551UII.				
	II.		ents, and Skills assessed	d·						
Group Discussion	III.	Effectively disa		٠٠,						
	IV.	•	marizing and Attaining	the Obi	ective					
(Theory)		δ,		<u> </u>						

- 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. 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						
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 III									
Course	Title	Т	echno-Professional Skill	s II (Bi	ofertiliz	zer pro	ducti	on)		
Course	Code	23MSBT215R	Total Credits: 2	L	T	P	S	R	O/F	С
			Total Hours: 60p	0	0	4	0	0	0	2
Pro	e-	Cell Biology,	Co-Requisite				NA			
Requ	isite	Biochemistry					INA			
Progra	amme		MSc. Bio		0.					
Seme	ester		Fall/ 3 rd Semester of							
Course 1. Appreciate the agronomic importance of beneficial micro-organisms					isms					
Objec			tudents learn and formulate b		zers					
			nd apply biofertilizers in a pil							
CO			nce of biofertilizers in plant	developi	ment.					
CO			vation and inoculation.							
CO			nce of Azolla as a biofertilize							
CO		•	ance of phosphate in bioferti							
CO	5	Apply the knowledg	ge on the use of Fungi and M	ycorrhiz	a.					
Unit			Content			CH Learning KL				
no								outco		
I			on, scope. A general account	_		10		portan		
	_	th promoters and regulators – Cyanobacterial Biofertilizer:					ofertiliz	zers in	1,2	
	Algal	ization – mass cultiv	ivation of cyanobacterial biofertilizers				pla			-,=
	NI'4	C-: D- 4 :	T 1 4' 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 4.6	4.	10	_	velopn		
II			Isolation, characterization, in		ition,	10		owled	_	
		s cultivation and inoculation method of Rhizobium and spirillum. Mechanism of nitrogen fixation (free-living and						oui ma Itivatio		1,2
	1	=	y and molecular basis of nitro	_				oculatio		
III	_		orphology – Mass cultivation			10		portan		
111			nd Ecological importance of					zolla		1,2
IV	Phosp	hate solubilizing Ba	cteria: Isolation, characteriza	tion,		10	Im	portan	ce of	
	identi	fication, mass cultiva	ation and inoculation method	of			ph	osphat	e in	
	Phosp	hobacteria. Biochen	nistry of Phosphate solubiliza	tion and	1		bio	ofertiliz	zers	1,2
mobilization. Carrier based inoculum production				ods and	Field					
		ation References	2 111				_			
V	-	•	fertilizers - Introduction, scor	_		10		ortanc	e of	
			d Arbuscular mycorrhizae (A		lation		Fur	-		1,2
			n of Arbuscular mycorrhizae	ycorrhizae (AM), Mycorrhiza					za	
	Legume - AM interactions									

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	N Course Outcome (CO) Mapped Program Outco							
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		Rese	earch E	thics					
Course Code	23UMRE211R	Total Credits:1	L	T	P	S	R	O/F	C
		Total Hours:60	0	0	0	4	0	0	1
Pre-Requisite	NA	Co-Requisite				N A	1		
Programme			Biotech						
Semester		Fall/ 3 rd Semester	of 2 nd ye	ear of t	the p	rogra	m		
Course		s to lay a foundation for en	-						
Ohioctivos		ts aware of relevant guidel	_		ıd cod	es rela	ting to	o ethical r	esearch.
		ts learn ethical theories and							
CO1		y research ethics theories a							
CO2	Explain research e	thics issues such as respon	sibility, v	etting,	and m	niscono	luct.		
CO3		s and results in ethical rese							
CO4		procedures for sampling, o			nd rep	orting	Ţ .		
CO5	Apply ethical prin	ciples to research design ar	nd evalua	tion					
Unit no			Content	t					
I	ETHICS: Introd	luction to the course and ea	ach other:	an inti	oduct	ion to	moral	theory. E	thics:
	definition, mora	philosophy, nature of mor	al judger	nents a	nd rea	ctions.	Rese	arch regu	lation;
	self – regulation	research ethics. Honesty,	candor, c	omproi	nise a	nd inte	egrity.	. Data ow	nership
	_	conflicts of interest; colla	boration.	Humar	and a	non-hu	man s	subjects. I	Research
	and researchers in society.								
II		ONDUCT- Ethics with res	-						•
		grity. Scientific miscondu						_	
	_	cations: duplicate and over	lapping p	oublicat	ions,	salamı	slicin	ig. Selecti	ve
TIT		srepresentation of data	1 . 1 .	.,.	• , ,		1.		D (
III		N ETHICS- Publication et ards setting initiatives and						-	
		ion misconduct: definition							
		ypes. Violation of publicat							ilavioui
		publication misconduct, co			_			_	and
	journals.	r		up	L-min	11000	J P		
IV		S PUBLISHING-Open acc	cess publ	ications	and i	initiati	ves. S	HERPA/I	RoME0
		o check publisher copyrigh							
		y publications developed b							
	viz. JANE, Else	vier Journal Finder, Spring	er Journa	l Sugge	ster, e	etc.			
V		MISCONDUCT Group l				•			
	_	icts of interest. Complaints			_				
		tools; Use of plagiarism so	oftware li	ke Turr	nitin, I	Urkund	d and	other oper	n-source
	software tools.								
		AND RESEARCH METE				_			
		of Science, Scopus, etc. Re			_		-		_
		Report, SNIP, SJR, IPP, C	ite Score	. Metrio	es: h-i	ndex, į	g inde	x, I 10 inc	dexes,
	altimetric.								

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		CORPORAT	E PRO	FICIE	NCY				
	2211MDD211D	Total Credits: 2	L	T	P	S	R	O/F	С
Course Code	23UMPD211R	Total Hours:60	0	0	4	0	0	0	2
Dua Daquisita	Communication	Co-Requisite				NA			
Pre-Requisite	Mastery								
Programmes		MSc. Biotechnology							
Semester		Fall/ 3 rd Semester of 2 nd year of the program							
	II	1							
		2. To acquire the speaking skill, instruct, influence, engage, educate, or appease the							
Course	listeners.								
Objectives	_	3. To increase proficiency, present ability and quality of resume and provide guidance for self- promotion and self-evaluation in social media.							
	_	ain the students for the			es & wa	lking ii	ntervie	ws	
CO1	Able to speak with greater					iking n	itter vie		
CO3	Discuss the positive impact					ing skil	ls		
CO3	Illustrate with all the nece								
CO4	Discuss the highlights and	<u>*</u>			T 1 2 1 2 1 3 1 1				
	Explain the impart in them				ıs in an	intervi	ew de	velon str	ateoies
CO5	to crack interviews, impro-	*						velop sur	negres
Unit no	7 1		ontent						
I	Module 1- Presentation								
	i. Introduction								
	ii. Essential characteristic	es of a good presenta	tion						
	iii. Preparation of a good	d presentation							
II	Module 2- Public Skills								
	i. Fear of Public Speaking		~						
	ii. Understanding and Ov		blic Spe	akıng,					
	iii. Confidence and Contr iv. Physiology and Stress	•							
	v. Tips for Presentations								
	vi. Tips for Using Visual								
	vii. Process for Preparing								
	viii. Delivering Presentat	ions Successfully,							
	ix. Doubt Clearing and S								
III	Module 3- Practical sess	sion on Resume, Cu	rriculu	m Vita	e, Writi	ing cov	er lett	er &	
	LinkedIn Profile								
	i. Preparation, submission								
	ii. Practical session on co iii. Creating a profile on l	_	ession						
	iv. How to utilize it	Linkeam							
	Module 4- Leadership &	& Management Skil	ls						
	i. Concepts of Leadership	_							
	ii. Leadership Styles,								
	iii. Manager VS Leader,								
	iv. How to be an Effectiv								
	v. Mock/ Practice Session								
11.7	vi. Doubt Clearing Sessi								
IV	Module 5- Research Page i. How to write a research								
	ii. Key point in Research								
	Module 6- Interview Sk		hics						
	i. Types of the interview-			face					
	ii. Online interview, person								
	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: The Indispensable 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								
Course Title		MINI RESEARCH (SURVEY/EXPERIMENTS-R3)							
Course code	23MSBT217R	Total credits: 2	L	L T P S R O/F C					C
		Total hours: 60P	0	0	0	4	6	0	2
Pre-requisite	Nil	Co-requisite				N	il		
Programmes		Master of Science in Biotechnology							
Semester	Spring/II Semester of First Year of the Programme								
Course	To develop stude	ents scientific method							
objectives									
CO1	To design an exp	periment using scientifi	ic meth	.od					
CO2	Apply the knowl	edge of sampling meth	ods in	sample	e colle	ction.			
CO3	To store and work on the sample through various parametric assays.								
CO4	To structurize da	o structurize data and perform statistical analyses.							
CO5	To interpret and	discuss the findings.							

		SEMESTER - III								
Course Title	P	ERSONALFINAN	CIAL	PLA	NNING	j				
		TotalCredits:1	L	T	P	S	R	O/F	C	
Course Code	23UUFL202R	TotalHours:30p	0	0	2	0	0	0	1	
	Introduction to	Introduction to								
Pre- Requisite	Financial Budgeting Co-Requisite NIL									
•	And Planning	*								
Programmes		Master of Science in	n Biot	techno	ology					
Semester	Fall/ 3 rd Semester of 2 nd year of the program									
Semester		rse would offer an inclusive approach to understand the relevant concepts of money,								
	borrowing, lending, taxes an						I),	
Course	2. Assess the personal finan	• •		•	_	ncial p	lans, a	and metl	hods	
Objectives	of goal achievement.	1 21		,		1	,			
o ajecti (es	3. Formulate a budget, reco	rd-keeping system, an	d tax p	olannin	g strate	gy base	ed on o	current		
	financial goals.		1							
CO1	Explain the cash manageme	ent and buying plan for	r home	es or au	ıtomobi	les.				
CO2	Discuss a diversified invest	ment portfolio for diff	erent o	bjecti	ves.					
CO3	Compare mutual funds, ETI	Fs, and real estate inve	estmen	t optio	ns.					
CO4	Develop a financial plan for									
CO5	Describe financial products									
Unit no	1	Cont		8						
Cint no	Unit 1- Fundamentals of F									
	i. Functions of money;	munciai i ianning								
	ii. Inflation- Meaning, causes, how it can be controlled;									
_	iii. process official planning,									
I	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 Plann									
	i. Meaning of Income,									
II	ii. Direct & Indirect Taxes,	Taxable Income, vario	ous he	ads of	Income	for tax	Calcu	ılation,		
	iii. Non-taxable Income,									
	iv. Tax evasion and tax avoidance,									
	v. GST, Tax Planning Strategies.									
	Unit 3- Entrepreneurial pl	_								
		i. Meaning of Entrepreneurship, prerequisites for becoming an entrepreneur,								
	ii. Entrepreneurship Suppor									
III	iii. Institutional support syst		,							
	iv. Financial support system	_								
	v. Venture Capital, Busines vi. Assistant of Governmen	•								
	vii. Commercial Bank Loan									
	Unit 4-Planning for invest		lzat							
	i. Investment avenues offere			imary l	Market	and Se	conda	rv Mark	et	
	ii. Stock market- meaning, t	-		-				-	υ ι,	
	iii. Security repository, stoc					_			of	
	orders, contract note, pay-ir	_	_				Pr			
IV	iv. Various risks involved in				-		ıl Inte	rmediari	ies;	
	Stock indices.	<i>5</i>		,					,	
		concept, definition, typ	es, in	nportar	ice and	drawba	icks of	f mutual		
	v. Mutual Funds- meaning concept, definition, types, importance and drawbacks of mutual funds, mutual funds in India, investing in mutual funds,									
	vi. Systematic Investment P	lan (SIP) and its adva	ntages							
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.

- 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	5							
	automobiles.								
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 -	Ш						
Course Title		Plant and Ani	mal]	Biote	chnol	ogy			
Course Code	23MSBT211R	Total Credits: 4Total	L	Т	P	$\overline{\mid \mathbf{s} \mid}$	R	O/F	С
		Hours: 45t+30p	3	0	2	0	0	0	4
Pre-Requisite	Cell Biology,	Co-Requisite			l	N	A	1	
-	Biochemistry,	•							
	Molecular								
	Biology								
Programme		MSc. B							
Semester		Fall/ 3 rd Semester o	f 2 nd y	year o	f the	progra	m		
	1. Introduction	on to the best use of Plant C	ell Cu	ılture r	nedia	as well a	s mair	ntenance	of aseptic
	condition.								
C		be the plant cell, its characte		_				mpositio	n, structure
Course		rties of the plant cell wall, a		•	•				C
Objectives	3. Introduction aseptic con	on to the best use of Animal	Cell	Cultur	e mea	ia as wei	ı as m	aintenan	ce of
	_	n of various cell to cell inter	action	n: adhe	esion	motility	and m	etabolic	co-
	operation.	if of various centro cent inter	actioi	ii, aair	,51011,	mounty	una m	ciacone	•
CO1		ed genetic modification tech	nique	es used	in bo	th plants	and a	nimals.	
CO2		strate the skills in plant and							gation
	methods.	•							
CO3	Describe the knowl	edge of biotechnology to er	hance	crop	yield,	improve	resista	ance to p	ests and
		ize agricultural practices.							
CO4		dge of biotechnology in me	dicine	and h	ealthc	are, part	icularl	y in the	context of
~~~	animal biotechnolo			11.					
CO5	Explain the ethical	issues related to plant and a	nımal						
<b>Unit No</b>		Content		C	H	1	earni	_	KL
	0.11.1.1	1. T. 1	1				utcor		1.0
I		ulture: Introduction to cell anaboratory facilities, Tissue	ıa			To lea			1,2
		emposition and preparation)				culture			
	· ·	nsion cultures: initiation and		10	)	Carrar			
	-	allus and suspension culture							
	mamicinance of c								
	single cell clones	•							
II	single cell clones	propagation, regeneration,				To har	ness ic	leas	1,2
П	single cell clones Tissue and micro production of hap	propagation, regeneration, bloids, protoplast culture and	l			on em	bryoge	enesis	1,2
II	single cell clones Tissue and micro production of hap somatic hybridiza	propagation, regeneration, bloids, protoplast culture and ation. Cloning in plants - Ti	l	8			bryoge	enesis	1,2
II	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic	I	8		on em	bryoge	enesis	1,2
	single cell clones Tissue and micro production of hap somatic hybridize plasmid organiza plants Bt cotton a	propagation, regeneration, bloids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications.	I	8		on em	bryoge ganog	enesis enesis	
III	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu	propagation, regeneration, bloids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. es of animal cell and tissue	I	8		on em and or	bryoge ganoge	enesis enesis	1,2
	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. es of animal cell and tissue media, growth factors,		8		on em and or To get knowl	bryoge ganoge the ba	enesis enesis	
	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. es of animal cell and tissue media, growth factors, es. Characteristics of cells i		8		on em and or To get knowl differen	ganogo the ba	enesis enesis asic n the	
	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. es of animal cell and tissue media, growth factors,	n	8		on em and or To get knowl	the basedge of	enesis enesis asic n the	
	single cell clones Tissue and micro production of hap somatic hybridize plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell-	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. es of animal cell and tissue nedia, growth factors, es. Characteristics of cells inhibition, anchorage	n ::11			To get knowl different technic	the basedge of	enesis enesis asic n the	
	single cell clones Tissue and micro production of hap somatic hybridize plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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.; Cound tissue response to trophiculture, immortal cells, cell	n ::11			To get knowl different technic	the basedge of	enesis enesis asic n the	
	single cell clones Tissue and micro production of hap somatic hybridize plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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.; Cand tissue response to trophi	n ::11			To get knowl different technic	the basedge of	enesis enesis asic n the	
III	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory.	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti tion. Concept of transgenic and other plant applications. The session of animal cell and tissue media, growth factors, the session of cells in the inhibition, anchorage the cell communication etc.; Cound tissue response to trophic culture, immortal cells, cell ance of cell lines in the	n ell c			To get knowl different technicanima	the baedge oent ques o	enesis enesis asic n the	1,2
	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory. rDNA products:	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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.; Cound tissue response to trophiculture, immortal cells, cell ance of cell lines in the	n ell c			To get knowl different technicanima	the backedge of the cell cell cell cell cell cell cell ce	enesis enesis usic n the f ulture	
III	single cell clones Tissue and micro production of hap somatic hybridize plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory.  rDNA products: I DNA products in	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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.; Cound tissue response to trophiculture, immortal cells, cell ance of cell lines in the	n ell c			To get knowl different technicanima	the backedge of the cell cell cell cell cell cell cell ce	enesis enesis usic n the f ulture	1,2
III	single cell clones Tissue and micro production of har somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory. rDNA products: I DNA products in somatostatin, vac	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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 trophiculture, immortal cells, cell ance of cell lines in the Brief idea about recombinar medicine (insulin, cines), Concept of Gene	n sill c			To get knowl different technicanima  To app knowl DNA	the backedge of the delayer of the backedge of the delayer of the	enesis enesis esic n the f ulture	1,2
III	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory.  rDNA products: I DNA products in somatostatin, vac therapy, Producti	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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.; Condition to the culture, immortal cells, cell ance of cell lines in the Brief idea about recombinar medicine (insulin, cines), Concept of Gene on of recombinant vaccines	n sill c	8		To get knowl different technicanima  To app knowl DNA manip	the backedge of the part of the backedge of the part o	enesis enesis esic n the f ulture f	1,2
III	single cell clones Tissue and micro production of hap somatic hybridiza plasmid organiza plants Bt cotton a Various techniqu culture: Culture r laboratory faciliti culture: Contact i dependence, cell- senescence; cell a factors. Primary of lines. d) Mainten laboratory. rDNA products: DNA products: DNA products in somatostatin, vac therapy, Producti hepatitis. Concep	propagation, regeneration, ploids, protoplast culture and ation. Cloning in plants - Ti 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 trophiculture, immortal cells, cell ance of cell lines in the Brief idea about recombinar medicine (insulin, cines), Concept of Gene	n sill c	8		To get knowl different technicanima  To app knowl DNA	the basedge of the color of the basedge of the color of t	enesis enesis enesis esic n the f ulture f	1,2

	humans and farm animals. Transgenic animals			
V	PR proteins, nematode resistance, marker- assisted selection – strategies for introducing genes of biotic and abiotic stress resistance in plants. Ethical issues of plant and animal biotechnology	9	To learn the applications of biotechnology in the field of plant science	1,2,3,4
Practical	Establishing a plant cell culture (both in solid and liquid media) – seed germination, callus culture, suspension cell culture, regeneration from callus cells. Cell count by hemocytometer. Artificial seed.	30	To apply the practical knowledge of plant biotechnology in various fields	1,2,3,4

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						

		SEMESTER - III	<u> </u>							
Course Title		Medical Bio		nolo	gy					
Course Code	23MSBT212R	<b>Total Credits: 4</b>	L	T	P	S	R	O/F	С	
		Total Hours:45T+30p	3	0	2	0	0	0	4	
Pre-Requisite	Molecular	Co-Requisite	3	-		N.		U	<u> </u>	
Tre requisite	biology	oo mequisite				11.	_			
Programmes	MSc. Biotechnology									
Semester		Fall/ 3 rd Semester of 2				narar	<u> </u>			
Schiester	To introduce	the students about human						e thera	av stems	
Course		ious diseases.	genor	ne pro	jeei, ee	лесрі	or gen	c meraj	by, stems	
Objectives		detail about diagnosis, trea	tment	t. cont	rol mea	asurem	ent of	various	diseases.	
Objectives	-	no biotechnology and its ap								
CO1	_	me Project and its importar	_		_	-				
		focusing on disease-associa								
		ield addressing genetic dise	_							
		of stem cells and its proper								
	_	ogy, explores and demonstr		icrobi	al dise	ases, p	rovidi	ng insig	hts into	
		rol measures for a holistic v				_				
CO5	Illustrate the concept	of nano materials, their syn	thesis	, and	applica	tions in	ı bios	ensors,	drug	
1	delivery, gene therapy	y, and cancer therapy.								
Unit no	C	ontent	<b>C</b> ]	Н	Lea	rning	outco	me	KL	
	Human genome Pro	-	10	0		rn the		and	1,2	
I	history, techniques,	ethics, application.			_	s of me				
				biotechnology  8 To harness ideas on 1						
	Gene therapy- Intro	_	8	;					1,2	
**	_	ase, Principle, types,			recent trends in the					
II	gene targeted for ge	= -		field of medical biotechnology						
	Humanized antibod activator, ethics, im	• • •			biotec	nnoiog	У			
		ction, Types of Stem	8	,	To ge	t the ba	sic		1,2	
III		em Cells Properties of	C	'	_	edge o		cell	1,2	
	Stem Cells	om comparage or			therap	_				
		roduction, Types of	10	0		rn abo	ut can	cer,	1,2,	
	Tumours, Predispos	sing factors for cancer,			diagno	osis and	d thera	pies		
	Cellular changes in	volved in Tumour			related	d to it.				
IV	-	of Tumour detection,								
1 4		- Chemotherapy and								
		obial diseases in Human								
	– mode of infection	•								
	epidemiology and c				- 1				1001	
		- introduction, Type of	9	'		rn abo			1,2,3,4	
	Nano Biosensor, Di	hesis of nano material,				ques fo		.nt		
		very, Cancer Therapy,			diseas		1111616	III		
$\mathbf{V}$		ano Material. Molecular			uiscas	CS				
	detection of presym									
		nce in health care, pre-								
	_	d genetic manipulation								
Practical		erium tuberculosis by	30		To ap	ply the	practi	cal	1,2,3,4	
		od. Diagnosis of venereal				edge o	-			
	disease by using VI	ORL test. Study of			of diff	erent c	isease	s		
	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	I							
<b>Course Title</b>		<b>Bioprocess and Fern</b>	ientat	ion I	Гесhn	ology				
<b>Course Code</b>	23MSBT213R	Total Credits: 4	L	T	P	S	R	O/F	7	С
		Total Hours: 45T+30P	3	0	2	0	0	0		4
Pre-Requisite	Biochemistry, Cell	CO-REQUISITE		ı	l	N	4	ı		
	Biology,									
	Microbiology									
Programme		MSc. Biot								
Semester		Fall/ 3 rd Semester of 2								
		train improvement technique	es, ino	culation	on proc	edures	, media	prepar	ratio	on,
Course	types and make up of bioreactors.  2. To tooch the industrial production of A con Alechela Organia Acida Amina Acida Antile									
Objectives  2. To teach the industrial production of Agar, Alcohols, Organic Acids, Amino Acids, Ant SCP, Vitamins, Enzymes.									ıtibi	otics,
3										
601		ge on upstream and downstr						1 1'		
CO1		al development in Bioproces	s Engu	neerin	ıg, key	inventi	ons an	d disco	veri	es and
CO2	its application in differential the design street	ructure, function, and operat	ion of	hiores	actors i	ncludin	o fime	tional	One	rations
COZ		tion in designs of bioreactors		oioica	1015 1	nciuan	ig, ruiic	tionar	орс	lanons
CO3		tion strategies of fermentation		ia and	d differ	ent sou	rce of 1	nutrient	ts fo	or
	fermentation media.	C								
CO4	Outline the technique	s of downstream processing	and di	fferer	nt isola	tion and	d purifi	cation	met	hods
	of biotechnological p									
CO5		ent fermentation processes in					ls and I	HACCI	P co	ncept
** • ·		safety measures in producin	-						T 7 1	r
Unit no	Content	7. 77'	CH			ing ou		;	Kl	
		E, History, application,	7		•	end of t			1,	2
	_	on for bacterial and fungal selection and strain				, studer and Bic				
	improvement	selection and strain				ring (E	_			
I	1				_	applica				
				to	echniqu	ues for	inoculu	ım		
				-		ion and				
					-	ement i				
	D' 1 1 1	1 · 1 ·	1.0			al proc			1.0	
		uction, basic design, struct, Temperature	10			and Bio	•		1,2	2
		affles, Agitation systems			-	applica				
		nentor, air supply and			-	upphet aes for				
II		oculation and sampling			_	ion and				
	methods, Specialize	ed bioreactor, Fluidized		iı	mprove	ement i	n			
	bed bioreactor, pac	ked bed bioreactors, Photo		n	nicrobi	al proc	esses.			
	bioreactor									
		on media, natural and	8			and fer			1,2	2
	synthetic media, M					ncludir	-	ral		
	_	of Carbon, Nitrogen, Buffers, Precursor,			-	thetic ty ormula	_			
		Antifoam agents, Solid				es, and				
***	state fermentation.	ugonio, bona			_	and rol				
III						nitroge				
						s, mine				
						precur				
						rs, indu				
						n agent				
				S	olid-sta	ate fern	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 principle, methods, Canning, Packing, Sterilization, Pasteurization	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
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									
Course Title		FOOD BIO	)TEC	CHNC	LOG	Y						
<b>Course Code</b>	23MSBT214R	Total Credits: 4		L	T	P	S	R	O/F	C		
		Total Hours:45p+30	)p	3	0	2	0	0	0	4		
Pre-Requisite	Molecular	Co-Requisite				1	NA		1			
•	biology,	•										
	microbiology											
Programmes		MSc. I	Biote	chnol	ogv							
Semester		Fall/ 3 rd Semester of				progr	am					
	Describe the	applications and current						lation	to food	ls.		
Course						_						
	biotechnolog	2. Knowledge on advantages and limitations of novel food products obtained through biotechnological approaches.										
Objectives	3. Apply the rol	e of microorganisms an	d enzy	ymes f	or the p	product	ion and	l trans	sformat	ion of		
	foods and mo	st recent advances in fo	ods m	nade of	with g	genetica	ally mo	dified	organi	sms.		
CO1	Explain the basic princ	ciples of fermentation.										
CO2	Describe selected fern	nentation systems.										
CO3	Discuss the mechanism	n of enzyme action and	classi	ficatio	n.							
CO4	Develop the skill to lin	nk food chemistry with i	indust	ry.								
CO5	Develop entrepreneurs	ship skills related to foo	d biot	echnol	ogy.							
Unit no		ntent		СН		Learn	ing ou	tcon	ne	KL		
I	Food biotechnology:			3	_		d the in			1,2		
-	historical developme						cal dev			1,2		
	1					techno	_					
II	Enhancing the nutritional quality of foods-			10			ods to		nce	1,2		
	manipulation of sucre			the	nutritio	nal qua	lity o	f	,			
	content: manipulation			food	ds throu	ıgh maı	nipula	tion				
	composition of oils,			of s	ucrose,	starch,	fatty					
	content, increasing th	e content of			acid	ls, prote	ein, vita	mins	,			
	methionine and lysin	_			min	erals, a	nd ami	no ac	ids.			
	proteins increasing th	ne levels of vitamins										
	and minerals.											
III		ing the anti-nutritional		12			ledge o			1,2		
	factors and toxic mol					_	to remo					
	phytate, oxalic acids,						ınti-nuti					
	decreasing the conter	=					ins, pe					
	herbicides and heavy					n food.	and he	avy n	netais			
	insecticides, develop	ment of herbicide			Iron	n 100a.						
IV	resistant plant etc.  Increasing the shelf l	ife of the fruits		12	Evn	lore m	ethods t	o inc	reace	1,2		
1 V	Development of food			12	_		fe and o			1,2		
	food colors, food Fla						s such a		_			
	sweeteners etc. Anim						vors, ad					
	increasing meat qual					sweete			,			
	production.											
V	Probiotics in foods: r	nethods of		8	Unc	lerstand	d anima	1		1,2		
	incorporation and typ						ogy for		oving	_		
		-					ty and p	_	_			
Practical	Isolation of probiotic	s microorganisms		30			ıt probi			1,2,		
	from different source	S			food	ds, incl	uding n	netho	ds of	3,4		
					I	_	on and	types	of			
					prol	oiotics	used					

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

	SEMESTER - III										
<b>Course Title</b>		MINI RESEARCH (SURVEY/EXPERIMENTS-R4)									
Course code	23MSBT224R	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 l	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 is	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	and perform statistical an	alyses.								
CO5	To interpret and dis	cuss the findings.									

		SEMESTER	IV							
<b>Course Title</b>	Course Title ORGANIC FARMING									
Course code	23MSBT221R	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				
Programme	_									
Semester	Spring/IV Semester									
Course objectives	<ol> <li>Introduction to Concept of Organic cultivation</li> <li>To discuss the Organic Farming System (OFS), its importance and benefits.</li> <li>To discuss the methods associated with organic farming – mulching, crop rotation, tillage, bio-fertilizer etc</li> </ol>							illage,		
CO1	Explain organic Farm	ing, its principles, scope and	l benefi	ts for t	he healtl	n and so	ociety.			
CO2	preparation and choic Discuss crop protection	between organic farming and e of crop varieties, planting on methods, analyse scenario	materia os, prop	l and s	eed treat	tment.				
		in pest and weed manageme								
CO4		roduction of rice, zinzer, tur	meric, ł	oanana	and veg	etables	•			
CO5	•	of soil less farming system.			Ī					
Unit-No.		ontent	C	H		arning			KL	
I	OF; Biodynamic Far	Principles and Types of ming; Need and Benefits Farming (CF) Vs (OF);	1	0	Understand organic farming, its types, principles, benefits and scope.			1,2		
П	crop/ varieties, Propa material and seed tre		8	3	Describe illustrate and explain the organic farming system			1,2		
III	Crop Protection: C method; Biopesticide Pesticides, Bio-contr Management		8	3	Describe and explain the various ways for protecting plants			1,2		
IV	"	action of Rice, Zinzer, ad Vegetables Yolk-its ances	1	0	Describe and explain the organic production of crop plants			1,2		
V	Concept on modern methods – Hydropo Hydroponics	_	9	)	Describe and explain the modern methods of agriculture			1,2		
Practical	given substrates.  2. Isolate, culture a which may be us  3. Apply any organ	nd identify microbes ed as a biofertilizer.	3	0	Apply knowledge of organic farming			1,2, 3,4		

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>	Environmental Biotechnology									
Course code	23MSBT222R	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			1	
Programme		Master of Scien	nce in	Biotec	hnolog	gy				
Semester		Spring/								
	1. The course aims	to provide an advanced und				cts of cl	imate	change,		
	biodiversity and en	vironmental management, p	ollutio	on and co	ontrol, j	populati	on dyı	namics,		
	ecosystems and urb	oanization.								
Course	-	nnology and human actions a		-	_		-			
objectives	-	ral resources. The study of				e helps t	o enlig	ghten the	world	
Objectives		, such as forest denudation a	-		_					
		edge gained through enviror				-	-			
		e environment can be preser							ecessary	
601		ment from destruction and a				om exti	nction.	•		
CO1		cept of climate changes and	their	manage	ment.					
CO2		y and their conservation.								
CO3		ternative fuels and their pro								
CO4		piodiversity and its role in b	_		cycles.	linking	micro	organisı	ns' eco-	
		ets to terrestrial ecosystem for		n.						
CO5	Describe environm	ental problems and solutions	s.							
Unit-No.	Content		(	СН		earning	-		KL	
1	Energy- Introduct	ion, Renewable and non-				To understand the basics of renewable				
	renewable energy	, resources and maintenance	:	6	ba					
						energy				
2		ction, sources and					-	ollution		
	_	oil, air and water pollution,			an	d water	manag	gement		
	_	rtant natural resources,								
	_	characteristic, treatment, Aerobic process- Activated sludge method, Oxidation ditch,								
	_	xidation pond Anaerobic		6					1,2	
	_	bic filter, Membrane		U					1,2	
	_	nent of dairy effluents,								
		lery effluents, treatment of								
		treatment of textile effluent	s,							
	-	industry effluents, CEPT,								
	reverse osmosis a	nd ultra filtration								
	Biomagnification-	- xenobiotic compounds and				learn a				
3		emediation-concept and				omagnif				
	principle, bioreme	ediation of xenobiotics, soil,			ph	ytoreme	diatio	n		
		ed with hydrocarbon and								
		nining, Bioleaching,		6					1,2	
	_	ioaccumulation of heavy							-,-	
		oring (Bio indicators),								
	-	Biofilm, Organ chloride								
	(Reduction)	each plant effluents								
	` '	gamanti introduction		6	Т-	learn a	hout			
4		gement: introduction, nent, waste as a source of		U						
4	_	on of plant fibre, cell wall,		applications of environmental biotechnology					1,2	
		wood and pitch problem,								
		and fuel from wood waste.					-51		I	

	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

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 cycles, linking micro-organisms eco-physiological aspects to	4						
	terrestrial ecosystem function.							
5	Describe environmental problems and solutions.	5, 4						

		SEMESTE	R - I	V							
Course Title Agriculture Biotechnology											
Carress	23MSBT223	Total credits: 4	L	7	Γ	P	S	R	O/F	C	
Course coo	R R	Total hours:45T+30P	3	(	0	2	0	0	0	4	
Pre-requisi	te Nil	Co-requisite			I		Nil				
Programm		Master of Sc	ience	e in 1	Biotech	nolo	gv				
Semester											
	1 To introduce the students about Rio pecticides Riofertilizersets										
Course	2 To study	post-harvest modification						ıts.			
objectives  3. To study the detail about seed certification process.											
CO1		y the concept of Bio pestici				to get	better	yield.			
CO2		cept of Post harvest modific							d/ vegetał	oles.	
CO3		us steps involve in seed cer							<u>U</u>		
	_	iples and techniques of gen				sed to	enhan	ce abio	otic stress		
CO4	1	s and to induce male sterili			corring a	ou ic	, ciman	oc uore			
			-	gv ir	n agricul	ture.	includi	ng gen	etic modi	fication.	
CO5	_	Illustrate the potential applications of biotechnology in agriculture, including genetic modification, crop improvement, and sustainable farming practices.									
Unit no	1 1	Content	1		СН	I	earni	ng Qu	tcome	KL	
1	Agricultural biotecl	nnology-scopes and applica	tion		CH Learning Outcom  To understand the ba					+	
_	8						agricul			1,2	
					biotechnology						
2	Biofertilizers-Defin	ition, Types (bacterial, fun	gal,			To learn abo					
	phosphate solubiliz	shosphate solubilizers, BGA,Plants-Azolla); Kind of				biofertilizers				1.2	
	association, Mode of	ssociation, Mode of application and merits, current								1,2	
	practices & product	tion of biofertilizers									
	Biopesticides- Intro	Biopesticides- Introduction, types (bacterial-Bacillus					To learn about				
3	_	hruingiensis, Viral –NPV, fungal-Trichoderma), Mode				biopesticides					
		f action, factors influencing, Genes involved and									
		ical approach in pest manag	_		10					1,2	
		NA technology for extending	_								
		wer, Importance of JH &JF	1 anal	logs							
	in pest controll	romant Aggaggment of magt	امست	at.		То	1	.lt	a a t		
_	_	ost-harvest management, Assessment of postharvest				To learn about post-					
4	_	osses due to storage pests; Environmental factors and corage pests in stored perishables, cereals and grain					harvest management				
		egumes; Major groups of post-harvest pests (insects,									
		egumes; Major groups of post-harvest pests (insects, nites and rodents)Management practices of						1,2			
	· · · · · · · · · · · · · · · · · · ·	rtant post-harvest pest; App	olicati	on							
	• •	n post-harvest management									
		g for abiotic stress, Male sto				То	learn a	about			
5	plant, method of inc	ducing male sterility, Bar st	tar an	d	8	apj	plicatio	ns of		1 2 2	
	barnase system				8	bic	techno	logy ir	1	1,2,3	
						agı	ricultur	re			
Practical		mulation of microbial biop	esticio	de					wledge		
	(bacteria, fungi and						agricul				
		of medicinal plants against	,			biotechnology					
	pathogenic microbe		,	1							
	_	mulation of microbial biop	esticio	ae	20					1,2,	
	(bacteria, fungi and				30					3,4	
	pathogenic microbe	of medicinal plants against	•								
		nodule& study of VAM,									
	Vermicomposting	noduled study of valvi,									
	Mushroom cultivat	ion									
	masin oom cumvat	.011			1					1	

# 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: 2.1

# 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 15th and 16th June, 2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

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 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: 96

# 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	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

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.

**Grade Points** Letter Grade **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.

# **Breakdown of Credits**

Sl. No	Category		Total number of Credits					
		Skill Enhancement Course (SEC)	-					
		Ability Enhancement Course(AEC)	5					
1	University Core(UC)	Field Training	-					
		Discipline Specific Elective (DSE)	-					
		Value Added Course (VAC)	2					
2	University Elective (UE)	Multidisciplinary Course (MDC)	8					
	Offiversity Elective (OE)	Value Added Course (VAC)	-					
		Discipline Specific Core(DSC)	26					
3	Program Core(PC)	Field Training	2					
3	riogram Core(FC)	Research /Industry Internship	19					
		Summer Internship	-					
4	Program Elective (PE)	Discipline Specific Elective (DSE)	18					
4	riogiani Elective (FE)	Value Added Course (VAC)	12					
5	Faculty Core(FC)	Skill Enhancement Course (SEC)	4					
3	raculty Cole(FC)	Ability Enhancement Course(AEC)	-					
	Total							

# **Breakdown by categories of courses**

Sl no	Category	Credits	%
1	Science	88	91.67%
2	Humanities and Management	8	8.33%
	Total	96	100%

# SEMESTER WISE COURSE DISTRIBUTION

	S.	Course Code	Course Code Course Title		E	nş	ga	g	em	ent		Maximum Marks for		for	
	N.			Category	L	T	P	S	R	o	C	IA*	SEE*	PE*	Total
	1.	23MSBO111R	Plant Diversity-I	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23MSBO112R	Plant Diversity-II	DSC	3	0	2	0	0	0	4	40	60	100	200
Semester I	3	23MSBO113R	Plant Ecology and Phytogeography	DSC	3	0	2	0	0	0	4	40	60	100	200
me	4	23MSBO114R	Bioinstrumentation	DSC	2	0	0	0	0	0	2	40	60	100	100
Se	5	23MSBO115R	Field study-I	Field training	0	0	4	0	0	0	2	0	0	100	100
	6	23MSBO116R	Mini Research (Review of literature-R1)  Fundamental of Statistics	Research						0	2	0	0		100
	7	23UMFS111R	MDC	l	ı	1		0	0	3	40	60	100		
	8	23UMPD111R	PDP-I						0	0	2	0	0	100	
		23MSCE111R	MOOCS-CEI  Total credits	VAC	0	0	0	0	0	0	2	0	0	100	
										25				1300	
			Course Title	Course	Engag			gement					[aximu		
	S. No.	('Auree ('Ade		Catanan				Τ			C		larks f SEE*		Total
	110.					T	P	S	R	O		IA	SEE	1 12	Total
	1.	23MSBO121R	Plant cell, Genetics and Plant Breeding	DSC		0	2	0	0	0	4	40	60	100	200
	2	23MSBO122R	Microbiology and Plant Pathology	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23MSBO123R	Plant Physiology and Biochemistry	DSC	3	0	2	0	0	0	4	40	60	100	200
er I	4	23MSBO124R	Techno-Professional Skills I	SEC	0	0	4	0	0	0	2	0	0	100	100
Semester II	5	23MSBO125R	Mini Research (Research gap analysis-R2)	Research	0	0	4	0	0	0	2	0	0	100	100
	6	23MSBO126R	Generic Elective	DSE	0	0	0	0	0	0	2	0	0	100	100
	7	23UMRM121R	Research methodology and Statistical Analysis	MDC					0	0	2	40	60	100	200
	8	23UUHV101R	Universal Human Values	VAC	ı	ı			0	0	2	40	60	100	200
	9	23UMPD121R	PDP-II						0	0	2	0	0	100	100
	10	23MSCE121R	MOOCS -CEII	VAC	0	0	4	0	0	0	2	50	0	50	100
			Total Credits								26				1500

	S. No. Course Code		se Code   Course Title	Course	En	ıg	ag	em	ent		Maximum Marks for			
	110.			Category	L.	<b>[</b> ]	PS	R	O	C	IA*	SEE*	PE*	Total
	1.	23MSBO211R	Techno-Professional Skills II	SEC	0	0	1 (	0	0	2	0	0	100	100
	2	23MSCE211R	MOOCS-III	VAC	0				0	2	0	0	100	100
	3	23MSCE212R	MOOCS-IV	VAC	0	0	)(	0	0	2	0	0	100	100
	4	23MSBO217R	Generic elective	VAC	2	0	)(	0	0	2	0	0	100	100
	5	23UMRE211R	Research Ethics	AEC	1 (	0 0	)(	0	0	1	50	0	50	100
	6	23UMPD211R	Corporate Competency	MDC	0	0	4 (	0	0	2	50	0	50	100
ır III	7	23MSBO212R	Mini Research (Survey/Experiments)-R3	Research	0	0	5 4	0	0	2	0	0	100	100
Semester	8	23UUFL202R	Personal Financial Planning	MDC	0	0 2	2 0	0	0	1	0	0	100	100
Š	6	Discipline specific elective (DSE): Student has to take any three												
	7	23MSBO213R	Floral morphology, Embryology and palynology	DSE	3 (	0 2	2 0	0	0	4	40	60	100	200
	8	23MSBO214R	Economic Botany, ethno botany and Pharmacognosy	DSE	3 (	0 2	2 0	0	0	4	40	60	100	200
	9	23MSBO215R	DSE	3	0 2	2	0	0	4	40	60	100	200	
	10	23MSBO216R	Plant Anatomy, Micro technique and Evolution	DSE	3 (	0 2	2 0	0	0	4	40	60	100	200
			Total							26				1300

	S. N.	Course Code	Course Title	Course		Er	ıga	gen	nen	t		Max	imum N for	Marks	
				Category	L	T	P	S	R	0	С	IA*	SEE*	PE*	Total
	1	23MSBO221R	Research/data												
			analysis/documentation-	Research	0	0	20	8	6	0	13	0	0	100	100
			R4)												
	Elective course: Student has to take any one special paper														
	Group I Elective Paper: Angiosperm Taxonomy														
	2	23MSBO222R	Angiosperm Taxonomy-I	DSE	3	0	2	0	0	0	4	40	60	100	200
Semester IV	3	23MSBO223R	Angiosperm Taxonomy- II	DSE	2	0	0	0	0	0	2	40	60	0	100
sste		Group II Elective Paper: Microbiology													
eme	2	23MSBO222R	Microbiology-I	DSE	3	0	2	0	0	0	4	40	60	100	200
Š	3	23MSBO223R	Microbiology-II	DSE	2	0	0	0	0	0	2	40	60	0	100
		Group III Elective Paper: Plant Ecology													
	2	23MSBO222R	Plant Ecology-I	DSE	3	0	2	0	0	0	4	40	60	100	200
	3	23MSBO223R	Plant Ecology-II	DSE	2	0	0	0	0	0	2	40	60	0	100
			Group IV Elective P	aper: Plant	Ph	ysiq	olog	gy a	nd	Bioc	hem	istry			
	2	23MSBO222R	Plant Physiology and	DSE	3	0	2	0	0	0	4	40	60	100	200
		2011102002210	Biochemistry-I	DOL	Ĺ	Ľ		Ů			·			100	
	3	23MSBO223R	Plant Physiology and	DSE	2	0	0	0	0	0	2	40	60	0	100
			Biochemistry-II			Ŭ	Ű	Ů	Ŭ					Ŭ	
			Total								19				400
			Total For all Four s	emester							96				4500

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

			SEMES	TER – I												
Course	e Title			Plant	Diversity-	-I										
Course	a code	23MSBO111R	Tota	l credits	: 4	L	]	ГΡ	S		R	O/F	C			
			Total ho			3	(	) 2	2 0		0	0	4			
Pre-rec		Nil		-requisit						Nil						
Progra	amme				cience in		•									
Seme	ester	II.	Fall/ I semes													
		1. Introduce the con-	cept of div	ersity, li	fe cycle j	patterr	n (	of v	ascu	ılar	and	non-	n-vascular			
		cryptogams.		1 .1	21 1							•				
Course O	bjectives	2. To make learner ur		out the l	Phylogeny	and e	eco	non	nic v	alue	S 01	vasc	ular and			
		non-vascular cryptogar		10,,,,,,,,	mto como d	lassa			alfam.							
CC	<b>\</b> 1	3. To impart various ap Describe the characteri									2001	rtonco				
	71	Describe the characteri	_								_		•			
CC	)2	importance.	siics, ideniii	y, Classii	y fullgi alic	ı iiciic	-11,	anu	шсп	CCO	11011	inc				
CC	)3	Describe the characteri	stics identif	v classif	y Bryonhy	tes an	nd 1	hei	r eco	nom	ic ir	nnorts	ance			
CO		Describe the characteri										•				
CO		Illustrate the industrial				-										
Unit-No.		Content	, .0	СН		Learn						<u>-</u>	KL			
I	ALGAE:	General account	of Algae.	8	Able to		_	_			ab	out				
		etic relationship, Class	•		the diffe											
		ee). Study of different			their ecor	onomic importance.							1,2			
	algae as	per the classification	n of Lee	_												
		conomic importance of														
II		General account	_	12		Able to describe and explain about										
		and Phylogeny, Class			the fung					and	l tl	neir				
		lexopoulos and Mims)	•		economic	impo	orta	nce	•							
		classes of fungi as										1.0				
		tion of Alexopoulos										1,2				
		conomic importance fur : General account														
		and reproduction, Cla														
		importance Lichen.	issification,													
III			ccount of	10	Able to	descri	ihe	ano	d ex	nlain	ab	out				
		es, Classification of			the diffe											
		Study of different			and their					-			1,2			
	Bryophyt	es as the classification	of Reimer,						•							
	Economic	c importance bryophyte	S.													
IV		<b>OPHYTES:</b> General		10	Able to					•						
	Pteridoph	• '			the differ				_			ytes				
	_	tytes (Smith), Study of			and their	econo	mi	c in	nport	ance	<b>:</b> .		1,2			
		of Pteridophytes as	_													
		tion of Smith (1955), ce Pteridophytes.	Economic													
V	_	D CRYPTOGAMS:		5	Able to	descri	ihe	201	1 ev	nlain	ah	out				
<b>'</b>		technology: algal biofu	els algal	3	the differ				-	-						
	_	zer, Algal culture, Biore	_		fungi.	one ap	'P''	Cuti	ons c	) I WIE	- C					
		Biotechnology: Prod		8								1,2				
	_	cid, Secondary metabol														
	Cell Prote	-	Č													
Practical		of range of thallus organ		30	Able to	expla	ain	aı	nd d	lemo	nst	rate				
	-	ductive structures of alg			different	groups	s o	f lo	wer o	crypt	oga	ms				
	_	of suitable representative											1,2,3,4			
	-	of morphological, anato											-,-,-, -			
	_	ive features of some fur	ngı													
	growing i	n Assam.														

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	1, 3,4, 6							
1	importance.								
2	Describe the characteristics, identify, classify fungi and lichen, and their	1, 3, 4, 6							
	economic importance.								
3	Describe the characteristics, identify, classify Bryophytes, and their	1, 3, 4, 6							
	economic importance.								
4	Describe the characteristics, identify, classify pteridophyte and their	1, 3, 4, 6							
7	economic importance.								
5	Illustrate the industrial, agricultural and environmental aspects of algae and	2, 3, 4, 6							
3	fungi.								

			SEMES										
	ourse Title				t Diversity	_							
C	ourse code	23MSBO111R	Total credits:		L	T	P	S	R	O/F	C		
	• • •	3.741	Total hours:		0P 3	0	2	0	0	0	4		
	e-requisite	Nil		quisite		D /		Nil					
	rogramme				f Science in Botany first year of the programme								
	Semester	1 T 14 141						nme					
Cour	se Objectives	<ol> <li>To understand the</li> <li>To make learner</li> </ol>						م برمایی	os of	<b>71 1122 12</b> O G			
		and angiosperms.	understand ab	out the	rnylogeny	and ec	OHOIH	c vaiu	es or §	gymnos	perms		
			nlain and demo	onstrate	the method	ls of pla	int exp	loratio	n techi	niques			
	CO1			emonstrate the methods of plant exploration techniques. fossils, and its role in oil exploration.									
	CO2	Describe the charact				_			nomic	importa	nce.		
	CO3	Describe the charac											
	CO4	Discuss the method		-						1	6,7		
	CO5	Demonstrate the me						1					
Uni		Content	1 1	СН			ning O	utcom	ie		K		
t-							J				L		
No.													
I	_	ne-scale fossilization	and Fossil	10	Able to	describe	and	explai	in abo	ut the			
		essions, incrustation,			geologica	l time s	cale an	d diffe	erent ty	pes of			
	_	etrifactions, coal bal			fossils.								
	_	earbon dating-Role									1,		
	_	alient features and af									2		
		perms- Pro-Gymnosp											
	_	ales, Bennettitales, Po	entoxylales,										
	Cordaitales	6.0 (0	1065)	0							<u> </u>		
II		of Gymnosperms (Sp		8	1								
	_	tudy of vegetative, as tructure of Cycadales	-		gymnospe importance		and	their	ecc	onomic			
	_	ferales, Ephedrales &	_		Ппроганс	С.					1,		
		ortance of Gymnosp									2		
		es of Gymnosperms	_										
		and Pteridophytes.											
III		olution of Angiosperi	ns; In	10	Able to	describe	and	explai	in abo	ut the			
	_	d flowers; Co-evolut			evolution	an		morph		of			
	and pollinators	s; Morphology of star	mens and		Angiospe	mic flo	wer.				1		
	_	nodia; nectaries; type									1, 2		
		f in feriorovary; place											
		Role of morphology a	nd anatomy										
	in plant taxono		D 3	1.0	411	1 "				, .4			
IV		assification: Linnaeu		10	Able to			-					
		akhtajan, Bessydicta			different		ificatio	on s	ystems	s of			
	-	ts and demerits. Inter Iomenclature, Botanio			angiosper	1115.							
		survey of India. Inter									1,		
		enclature (ICN). Histo									2		
		major rules of nome	-										
	_	a, species, genus and											
	traspecific cate		<b>3</b> /										
V		ant exploration; Man	agement of	7	Able to	describe	and	explai	in abo	ut the			
		r herbariain India and	-		methods o			-					
	Specimen prep	oaration for herbariur	n, Role of								1,		
	herbariain taxo	onomy. Charcteristic	feature,								2		
		d botanical description											
	importance of	selected order-Fabal	es, Rubiales,										

	Lamiales, Malpighiales, Liliales & Poales							
Pra ctic al	Lamiales, Malpighiales, Liliales & Poales  1. Study of some important genera of gymnosperms available in NE India with respect to their morphology, anatomy and reproductive structures.  2. Study of Angios permic flowers as well as stem and leaf with analytical drawings.  3.  Collectionandpreparationofherbariumspecimens of common plants for familiarization of herbarium te	30	Able	to	explain ns and ang	and iospern	demonstrate ns.	1, 2, 3, 4
	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							

			SEME	ESTER – 1	[										
Cou	ırse Title		Plan	t ecology	and phyto	geogra	phy								
Cou	ırse code	23MSBO111R		redits: 4	L	Т	P	S	R	O/F	C				
			Total hour		0P 3	0	2	0	0	0	4				
	-requisite	Nil	l .	quisite				Nil							
	gramme				Science in										
	emester	1.5	Fall/ I sem												
Course	Objectives	1. To study about pl	-						4	1	4				
		<ul><li>2. To study about er</li><li>3. To study about Po</li></ul>								ı ecosys	tems.				
		4. To study about 16	_				_			riers to	nlani				
		migration, centers of origin, different Phytogeographical regions of India and the Biodiversity significance of NE region.													
	CO1	Explain the factors influencing environment.													
	CO2	_	Explain population and community ecology.												
	CO3	Describe ecosystem													
	CO4	Explain the principle			or conserv	ation.									
	CO5	Describe principle	* *		dynamisn		phyto	geogr	aphy,	demon	strate				
		phytogeography of l	ndia.				-	-							
Unit-	Content			СН	Learning	Outco	me				K				
No.											L				
I		onment: Physical e		1	Able to 1					system,					
		onment, Concept of			environme	ent and	global	warm	ing.						
		width and overlap;													
		d niche; resource													
		isplacement. Laws	_								,				
		ronmental pollution	_								$\begin{vmatrix} 1, \\ 2 \end{vmatrix}$				
	_	types of pollutants air, soil and wate									2				
			lution level,												
	1 -	pollution on plant													
		bal warming and en													
		en house gas, acid ra													
П	Population		Community	8	Able to	describ	e and	expla	in abo	out the					
	Ecology:	<i>S</i> <b>v</b>	·		population			_							
	Characterso	fpopulationecology,d	ensity,Size												
	ofpopulation	n,Spatialdistribution,a	igestructure,												
		tality,bioticpotential,	populationd								1,				
	ynamics,gro										2				
		n,competitionandco-													
	_	peciesInteractions,Co	-												
		eofcommunities;com	mumiystruc												
III		Ecology: Ecosyste	n structure	10	Able to	evnlain	ahou	t the	structu	re and					
111	ecosystem	function; energy		1	function o	-			ou uctu	ic and					
	Biogeochem		Ecosystem:												
	_	c cycles, mineral cy	•								1				
	_	ture and function of									1,				
	· ·	terrestrial (forest, gr									2				
	aquatic														
	-	marine, estuarine),	Ecological												
	succession.														
IV	Conservation		nciples of		Able to d			-		nature					
	conservation		paches to		and its con	ıservati	on stra	tegies	•		1,				
	managemen	*	studies on								2				
	conservation	n /management strat	egy (Project								<u> </u>				

	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 T	itle	Bioinstru	ument	ation									
Course co	ode 23MSBT111R	Total credits: 2	L	T	T P S R				C				
		Total hours: 30T	2	0	0	0	0	0	2				
Pre-requi	isite Nil	Co-requisite				Nil							
Program	me	Master of Science in Botany											
Semeste		Fall/ I semester of first year of the programme											
Course		1. Working principle of chromatography, centrifugation, PCR, microscopy, gel electrophoresis etc.											
Objectiv		2. To understand the different types of chromatography, microscopy etc.											
		3. Application of Electrophoresis, Blotting and Microscopic Techniques etc.											
CO1		stand and differentiate											
CO2		mprehensive knowledge o	•		rinciple	s, and a	applicat	ions of ge	el				
	_	electrophoresis, PCR, blotting technique and microscopy.											
CO3	_	lifferent separation tech					tion.						
CO4		adio-Isotope Dating an			ations.								
CO5		stand spectroscopic me											
Unit-	Cont	Content CH Learning Outcome					1e	KL					
No.													
I	Chromatography: Histor	•	7		Able to describe, illustrate and								
	principles, operation, appli	• . •		1 -	explain the chromatography and								
	Column, Adsorption column			the	ir appli	cations			1,2				
	Ion exchange, quantitative	e Ion exchange, and Gel											
TT	Chromatography):	A 1' 4' T	0	A 1 1	1 , 1	•1	*11 4	, 1					
II	<b>Gel Electrophoresis:</b> Principle; pH meter (Pri	Application; Types;	8				-	rate and is, PCR,					
	Introduction, types and			1 *	nam me tting		opnores mique	and	1,2				
	technique: Southern, We				croscop		iiique	anu	1,2				
	Microscopy: Introduction,			IIIIC	ловсор	у.							
III	Centrifugation: Types;		5	Ah	le to d	escribe	illust	rate and					
111	rotors; density gradient & a				olain the			ano una					
IV	Radio- isotope dating t	_	5					rate and					
.,	nature, detection & measure	-											
	radioisotopes & radiation,	•					P		1,2				
V	Spectroscopic techniques	-	5	Able to describe, illustrate and									
	and application of spectros	=					oscope		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	Į.								
Course '	Title		Field	d stud	y-I							
Course	code	23MSBT111R	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 Science in Botany										
Semes		Fall/ I semester of first year of the programme										
Course Ob	•	_	nts the field knowledge of				_	_	ups.			
			l plants from their habitat f	•	-			1.				
		-	a particular area and prepa									
CO1 Illustrate the methods of plant specimen collection and preservation.												
CO2 Summarize strategies for plant specimen sample collection.												
CO3 Explain the methods of management and n						-	rved pl	ant spec	imens.			
CO ₄		Identify and preserve plant species of different plant groups.										
COS	;	Write comprehensive report on the field exploration.										
Practical		Cont		СН		Lea	rning (	Outcom	ne	KL		
	1. Fiel	dtrip/excursion to th	e neighbouring states of	60	Ab	le to d	escribe	e, illusti	rate and			
		• •	the collection and		_				bitats of			
	_		imens like algae, fungi,		lso able							
			lophytes, gymnosperms						explain			
		giosperms from their							ion and	1,2		
			llected specimens from		preservation of specimens.							
		y herbarium techniqu										
	3. Preservation of the collected algae, fu											
	specimens from field by preservatives.											
	_	=	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 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								
Course Title	MI	MINI RESEARCH (REVIEW OF LITERATURE-R1)									
Course code	23MSBT114R	Total credits: 2	L	T	P	S	R	O/F	C		
		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 First	st Yea	r of th	e Prog	ramm	e				
Course	To develop student	ts scientific writing skil	1								
objectives											
CO1	Develop competen	ce in writing and abstra	ctings	skills.							
CO2	Evaluate and under	rstand technical writing	skill.								
CO3	Comprehend differ	rent methods and techni	ques o	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	tals o	f Statist	tics							
Course	code	23UMFS111R	Total credits: 3	L	T	P	S	R	0	<b>/F</b>	C		
			Total hours: 30T+30P	2	0	2	0	0	(	)	3		
Pre-requ		Nil	Co-requisite				Nil						
Progran		Master of Science in Botany											
Semes		Fall/I Semester of First Year of the Programme  1. Help to understand the role of statistics in data analysis, decision-making, and scientific											
Course obj	•	-	derstand the role of statisti	cs in	data ana	ilysis, de	ecision	ı-makıng	g, and	sc1e	entific		
		research 2. Introduce	students to descriptive st	totisti	os inoli	idina m	100 C11#	es of ce	ntro1	tone	lanov		
			_			_					dency		
		mean, median, mode) and measures of dispersion (range, variance, standard deviation).  B. Teach students how to summarize and present data effectively using tables, charts, and											
		graphs.											
COI			ing of Descriptive Statistic	s and	Demog	raphy.							
CO2			to understand the Probabi				on, and	d sampli	ng me	ethoc	ds.		
CO3			e to understand the met										
		analysis.			71			-	•	-			
CO ₄	4	Develop knowledge to understand the principles of various statistical analyses of data.											
COS	5	Develop knowledge	on R language for data an	alysis	S								
Unit-No.		Cont		CH		Learnin					L		
		•	5				standing	of	1,2				
		-	atistical population and		Statistic	al Conc	epts						
	_	_	nd qualitative, attributes,										
			rement nominal, ordinal,										
		and ratio.	1 1' 1 ' 1 1'	ļ	D		D.	D .		1.0			
			d graphical, including	5	1	-	Data	Present	ation	1,2			
histogra		•	Measures of Central dipositional. Measures of		and An	arysis							
		-	eviation, mean deviation,										
	_		nt of variation, skewness										
	and kurt		iii or variation, sixe whess										
			scatter diagram, simple,	5	Knowle	dge	on	Analy	/zing	1.2.3	3		
			ation (3 variables only),			-		lationsh		, ,			
1	-	•	ear regression, fitting of						•				
	polynon	nials and exponential	curves.										
IV	Randon	n experiment: trial,	sample point and sample	8	Underst	anding	of Pro	obability	and	1,2,3	}		
	space,	event, Operations	of Events, concepts of		Distribu	itions							
	-		austive events. Definition										
	_	•	and relative frequency										
		-	lity space, Properties of										
I I	F.	-	of events, Conditional										
l i	probabıl Normal		pound probability rules, Distribution, Binomial										
	Normai probabil		Poisson Probability										
1	-	•	and its applications.										
			ametric test: t-test, z-test,	7	Applica	tion of	Hypot	hesis Te	stino	1.2 3	}		
	_	• •	netric test: One sample	,		tistical T			g	- ,,-			
	_		on Signed test, Mann-				٠						
	_	Test, Kruskal wails	_										
			ogramming language and	30	A brief	knowle	dge or	n using l	R for	1,2,3	3,4		
			s and graphics. Syntax of				-	alization					
	R expr	essions: Vectors a	and assignment, vector										
	arithmet	ic, generating reg	gular sequence, logical										
			lex vectors; selecting and										
		ng subsets of dataset											
	2. Data	objects: Basic data o	bjects, matrices, partition										

of matrices, arrays, lists, creating and using these	Ī		
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:

 $\underline{https://www.sciencedirect.com/journal/computational-statistics-and-data-analysis}$ 

	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 -											
Course Ti			CTIVE ENGLISH (Con		<del> </del>		_							
Course co	de	23UMPD111R	Total credits: 2	L	T	P	S	R	O/F	C				
D		Nil	Total hours: 60P	0	0	4	0	0	0	2				
Pre-requis		Nil	Co-requisite	<u> </u>	D = 4 =		Nil							
Programn Semester		Master of Science in Botany												
Course object		1 To introdu	Fall/I Semester of First Year of the Programme											
Course object	uves		<ul><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></ul>											
			rize the students with	•		•	_		_					
		organizatio			F									
		_	ethe3P's (Planning, priori	itizing & 1	erform	ing) o	f Time	Man	agement					
		5. To give ins	ight into English pronunc	iation and	l into ce	entral o	concep	ts in	phonetics	š.				
CO1		This course will ena	ble students to analysis a	nd identif	y the di	fferen	t types	of se	ntences.					
CO2			able to integrate the sl	kills of 1	reading	and	speaki	ng i	n profes	sional				
		communication.												
CO3		_	e sessions will boost their											
CO4			about the effective and eff											
CO5			netics and its importance											
Unit		Content Contact				Leari	ning O	ut Co	ome	KL				
	Gran	nmar Interchange o	f Interrogative and	Hour	1 Iden	tify ar	nd unde	erstar	nd the	+				
		tive Sentences, Exc		Identify and understand the structure of interrogative and										
		ences, Types of Tens		assertiv										
		/nonyms, Antonyms, Homonyms			Transfo									
					gramm formati			cy ar	nd senten	ce				
	Read	ling Skills			2. Deve			es for	faster					
		niques of Effective I		reading with better comprehension										
	and ii	information from a text The SQ3R Technique			and improve the ability to recall									
	Interp	oret the text	and organize textual information systematically.											
	Liste	ning Skills			3. Und			undaı	nental					
		is listening? The Pr	ocess of Listening,		aspects and importance of									
	Facto	ors that adversely aff	ect Listening, Difference	listening. It also helps to enhance interpersonal and professional										
		een Listening and Ho	O. 1		commu									
MODULES	_	rtance of Effective I	_		listenin			F	8					
		ove Listening Proces	SS,											
		lict Management							nage and	1				
	I		ict Management, Effects		resolve				ironmen	f				
			Methods to deal with		by turn				ii oiiiiieii					
	Coni	licts (Negative)			opporti	unities	for gr	owth						
		-Management Skill		5. Enhance productivity and stress										
			nagement, Purpose and	management through effective time allocation and planning. It helps to										
	I	rtance of Time Manatain Time.	agement, Basic Tips to	understand the importance of time										
					manage	ement	in ach	ievin	g					
		-	ng activity: A situation		persona	al and	profes	siona	ıl goals.					
		-	nts and they will have to situation or solve the											
	probl		Situation of Solve the											
	hron	em.												

# 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	MOOCS-I									
Course code	23MSCE111R	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		Fall/I Semester of Fi	st Year	r of the	Progr	amme				
Course objectives	As per the course of	opted.								
Course outcomes	As per the course opted.									
Course description	As per the online r	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	Title		Plant cell, Ger			Bree	din	_				
Course	code	23MSBO121R	Total c			L	T	P	S	R	O/F	C
-	• • •	270	Total hour			3	0	2	0	0	0	4
Pre-req		Nil		quisite						Nil		
Progra		***			nce in Bot							
Seme		II.	ter/II semester								4 .	1 2 1
Course Obj	ectives	. Introduce the basic concepts of genetics, helping students to develop their analytical,										
		quantitative and problem- solving skills from classical to molecular genetics.  2. To provide insight into structure and functions of chromosomes, chromosome mapping,										
		olyploidy and cytogenetic aspects of crop evolution.										
		3. To impart theoretical k	_	_		out pl	ant	bre	edi	າຍ ດັ	biectiv	es. modes
		of reproduction and genet				_				_	-	,
CO	1	Describe the structure, fur										
CO	)2	Explain structure and fun-	ction of chroma	tin, DN	NA conden	satio	n, p	lant	су	tosk	eletal g	genes, cell
		cycle and apoptosis.										
CO	)3	Describe chromosome st	•	olveme	ent in sex	dete	rmi	nati	on,	abe	erratio	ns and its
		impact on crop evolution.										
CO		Explain the structure, reg		-								
CO	05	Describe hybridization,	_	ease re	esistance,	trans	gen	es a	and	pra	actice	backcross
TI I NI	<b>a</b>	methods of plant breeding	g. 	CII								***
Unit-No.	Content	function = 11'	a of c-11 11	<b>CH</b> 10	<b>Learnin</b> Knowled				4		C 11	KL
I		e, functions and biogenesi na membrane. Structure a		10	and its or	_			tur	2 01	cen	
	_	nic cell organelles and			and its of	gane	1108.					
	Nucleus:							1,2				
	complex,		- 1									
	cytoplasr	=										
II		in structure in eukaryotes,	condensation	8	To lear	n th	e i	basi	c	stru	ctural	
	and pack	aging of DNA in prokaryo	otes. Structure		organisation of chromatin and			and	1,2			
		ction of plant cytoskelet	_		genes.							
	gene pro	ducts. Cell cycle and apop	tosis.									
III		some: Structure and	<i>'</i>	10	To knov			he	chr	omo	some	
		ere and telomere. Sex			and its b	enavı	our.					
		sms, sex chromosomes,										
	aberrations deletions	1 ,	deficiencies/ interchanges/									1,2
		tions. Role of chromosom										
		evolution. Ploidy chang										
	_	ds and aneuploids.	,									
IV		ructure of gene. Prok	arvotic gene	10	To unde	rstand	1 th	e ha	asic	s of	gene	
1,		n. Mendelian and N		10	structure						-	
	_	ce. Chromosome theory of			modifica		-	_		1		
		cic Genome: Evolution,										
	_	tion. Gene regulation. Rec										1,2
		es. Linkage and crossin										
		, linkage maps, correlation										
	_	hysical maps, Post	translational									
<b>X</b> 7		tions of eukaryotes.	t h	7	A 1-1 - 4	L	'1			1 .	·1	
V		es and scope of plantion in self and cross-pol	-	7	Able to about t						-	
	-	basis of inbreeding de	_		breeding		meu nd	noa it:			ferent	
	_	. Breeding for disease	-		applicati		1U	111	و	uII	ioi CIII	1,2
		e, transgenes and trans			аррисан	J11U.						
		gene transfer through										
					İ							1

	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 et al (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							
2	To provide insight into structure and functions of chromosomes, chromosome mapping, polyploidy and cytogenetic aspects of crop evolution.	1,2							
3	Describe chromosome structure, its involvement in sex determination, aberrations and its impact on crop evolution.	1,4							
4	Explain the structure, regulation of prokaryotic and eukaryotic gene and its function.	1,2							
5	Describe hybridization, inbreeding, disease resistance, transgenes and practice backcross methods of plant breeding.	1,4							

			SEME	STER – II									
Course	Title		Microb	oiology and	Plant I	Patholo	gy						
Course	code	23MSBO122R		credits: 4	L	T	P	S	R	O/F	C		
				rs: 45T+30	P 3	0	2	0	0	0	4		
Pre-requ		Nil		equisite				Ni	l				
Prograi		Master of Science in Botany											
Semes		Winter/II semester of First year of the programme  1. The course deals with the introduction, distribution/ diversity of microbes in soil, water, air, milk											
Cour Object		and its application in the field				ersity o	of mic	robes 1	n soil,	water, a	ır, milk		
Object	ives		_		-	micro	organ	isms a	nd thei	r growth	n in the		
		2. To make learner understand the method of isolation of microorganisms and their growth in the laboratory condition and also various culture techniques and instruments used for microbiological											
		studies.											
		3. To impart the concept of symptomology and epidemiology of different plant disease.											
CO	1		Describe about diversity of microorganisms.										
CO	2	Demonstrate the method of is	olation, p	ure culture,	preserv	ation c	of mic	robes	and des	sign to e	stimate		
		microbial growth.											
CO	3		Describe application of microorganisms in agriculture, fermented food, dairy, bio-waste										
CO	4	management.	nanagement. Explain innate and acquired responses, antibodies, cells and tissues of immune system, serological										
(02	4		eactions and sero diagnostics.										
CO	<u> </u>	Describe symptomatology, e		ogy and ho	st-natho	gen re	lation	shins	defens	e mech	anisms		
	3	and strategies for plant disease			or paine	gen re	iunon	ompo,	detens	e meen	amomo		
Unit-		Content		СН		Lear	rning	Outco	me		KL		
No.							O						
I	Micro	obial diversity- 'Species' and	'Strain'	10	Knowle	edge of	f mici	obial	diversi	ty and			
		ept in microbiology, ICN for			ecology	<b>/.</b>							
		ria and other microbes, micro									1,2		
	conce												
	and n	bbes, microbiology of soil, ai	r, water										
II	Micro		of	10	To le	earn	about	the	e mio	crobial			
		obes, pureculture, preservation		10	techniq		uoou.	·	, 1111	orociar			
		ılture, growth, media ster											
	and	disinfection, sterilization tecl	hniques,								1,2		
		lation estimation (directs por									1,2		
		spectrophotometric method											
	cultu		hniques,										
TIT		re preservation and maintenand		7	To lea	ala	at t		-licatio				
III		ied microbiology- Applicated bess in the field of agr		/	microb				_	ons of			
		ented foods and dairy p			microo	lology i	iii diii	CI CIII 3			1,2		
		try and bio-waste managemen											
IV		unology- Immunity, Innat		8	To u	ındersta	and	the	basic	s of			
	_	red immunity, antibodies, co			immun	ology a	nd ca	ncer bi	ology.				
		es of the immune system,									1,2		
		diseases, serological reactions and sero-											
	diagn	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	<ol> <li>Isolation and pure culture of microbes from soil, air, water and disease plant materials.</li> <li>Identification and characterization of isolated pure cultures.</li> <li>Estimation of bacterial growth by spectrophotometric method and counting of cells.</li> <li>Study of plant pathogenic fungi from diseased specimens (symptoms, causal organism and their morphological &amp; reproductive characters.</li> </ol>	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		

			SEMEST	ER – II									
Cour	se Title				and biochemistry								
Cour	se code	23MSBO123R		Total cr	edits: 4	L	Т	P	S	R O/I	C		
			Tot	tal hours	: 45T+30P	3	0	2	0	0 0	4		
Pre-r	equisite	Nil		Co-req	<b>Juisite</b>				Nil				
Prog	ramme		Maste	r of Scie	nce in Botany								
Sen	nester				st year of the prog								
	urse	1. This course aims to educate		_		mes.							
Obje	ectives	2. Basic plant signaling mecha											
				hysiology of plant hormones, reproduction, enzymo									
		metabolism, photosynthesis an											
	201	Describe membrane transport											
	CO2	Explain mechanism of electro	_	t system	during photosynth	esis	and p	oathy	vay	of			
	102	photorespiration and respiration		.1.4:	· · · · · · · · · · · · · · · · · · ·		IZ:	4:					
	203	Describe plant hormones, enz Explain structure of protein ar				yme	Kine	encs	·				
	CO4 CO5	1			•								
Unit-	Content	Describe signal transduction is	n Dacteria	CH	Learning Outco	me					K		
No.	Content			СП	Learning Outco	utcome				L			
I I	Membra	ne transport and trans location	of water	10	Knowledge of pl	ant 1	ransı	nort	and	stress			
•		te. Stress physiology: Waterstr			biology.			7011	-	. 541 € 55			
		oldstress. Flooding and ROS f			<i>G</i> , .						1,		
		lative stress (Uniport, Sympo									2		
		nnels, Pressure flow model,											
	rapping r	node).											
П	Photosyn	thesis: Light harvesting	system,	10	To learn about the	he pl	lant p	hote	osyı	nthesis			
	Mechanis	sms of electron transport	, photo		reactions.								
	protectiv	e mechanisms, CO2 fixation	-C3, C4										
		M pathways. Respiration an	d photo								1,		
	respiration		-								2		
		ndrial electron transport ar											
	*	, alternate oxidase, photo re	spiratory										
	path way		1 1	7	T 1 1 1	41	1 :		1 '	1	-		
III	1	rmones: Biosynthesis, storag d translocation. Mechanism of		7	To know about applications of p			-		is and			
		normones. Enzyme and re			applications of p	iaiii	110111	ione	5.		1,		
	_	kinetics and other growth re	_								2		
		on of Michaelis Menten equation	_										
IV		tructure and protein synthesis		8	To understand the	ne nr	otein	strı	ıctu	re and	1		
1	1	, degradation, purification,			functions.	r.							
	_	tional characterization), Appli											
	principle	s of thermodynamics in biology	y. Nitrate								1,		
	and am	monium as similation, ami	no acid								2		
		esis complex, Translational	_										
	_	Translational inhibitors an	d Post-										
		onal modification of proteins.											
V	Signal	Transduction: Overview	second	10	Able to describe		-		abo	out the			
	messenge	_	proteins,		signal transduction	on in	ı plar	ıts.					
	phosphol		•								1,		
		les, specific signalling, mechan									2		
	their	regulation. Specific si smin bacteria and plants.	gnalling.										
Pract		rmination of water potentia	al neina	30	Describe, illustr	rate	and	evi	aloi:	n and	1,		
ical		ric method.	ıı uəmg	30	apply plant		and [ysio			and	2,		
icai	_	nction of carbohydrates fro	m nlant		biochemical reac	-	•	ogi	uı	and	3,		
L	L. DAUG	caron of caroonyuraics no	Piani	1	orochemical reac	tiOII	<i>.</i>				٠,		

materials and estimation of reducing and non-	
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	ultivati	ion)					
Course code	23MSBO124R	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									
Programme		Master of S	cienc	e in Bot	tany							
Semester		Winter/II semester of F	irst y	ear of	the pro	gramn	ne					
Course objectives	1. To create aware	ness about the Mushroom	amor	g the p	eople.							
	2. To strengthen	To strengthen the promotion of mushroom cultivation by establishing a well-equiped										
	laboratory and	laboratory and offices.										
	3. To know and ex	To know and explore the cultivation in Assam.										
CO1		scribe the method of producing mushroom spawn and the cultivation process for mushrooms,										
	including substrate	preparation, inoculation	n, an	d env	ironmei	ntal co	ondit	ions r	equi	red for		
	successful growth.											
		ues involved in fungal cul						-		as agar		
	•	l culture techniques, and s	•									
CO3		ues for cultivating mushr			_				ing	optimal		
		re, and light conditions, as										
CO4		ement of spent mushroon				_	egies	for co	mpo	sting or		
		recycle organic waste and				-						
CO5	*	rcial aspects of mushroor				_		•	is, t	ousiness		
		gies for developing entrepr										
Practical		ontent	СН			ning O				KL		
	1	niques for production of	60		erstand		-	cellu	ar	1,2, 3,4		
	-	Staining techniques:		orga	nızatıoı	n and fi	and functions					
		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 (R	esearcl	ı gap a	nalysis	-R2)				
Course code	23MSBO125R	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	Nil							
Programme	Master of Science in Botany									
Semester	Winter/II semester of First year of the programme									
Course	1.To determine whe	ther the objectives of re-	view of	literati	ıre gap	analys	is ha	ve been	n met, if not	
objectives	what steps can be tak	en accordingly.								
CO1	Create and implemen	nt a plan to bridge the gap	)							
CO2	Find the gap and eva	luate solutions.								
CO3	Identify the ideal fut	ure state/action plan								
CO4	To analyse the curren	nt state/work of research								
CO5	To implement the str	ategies to meet the resear	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	23MSBO126R	Total credits: 2	L	T	P S R O/F 0 0 0						
		Total hours: 30T	0	0 0 0 0 0							
Pre-requisite	Nil	Co-requisite		Nil							
Programmes		Master of S	Science	in Bota	ıny						
Semester		Winter/II semester of	First ye	ar of tl	ne prog	ramme	e				
Course objectives	As per the course op	ted.									
Course outcomes	ourse 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

As per the online material available.

# Reference:

 $\underline{https://www.coursera.org/programs/assam-downtown-university-on-coursera\ rzqtn?currentTab=CATALOG}$ 

COURSE TI	TLE		Research Methodolo	ogy an	d Stati	stical A	nalysi	S				
Course co	de	23UMRM121R	Total credits: 2	L	T	P	S	R	O/f	C		
			Total hours:15T+60S	1	0	0	4	0	0	2		
Pre-requis	site	Nil	Co-requisite				Nil					
Program	ne		Master of	Scienc	e in Bo	tany						
Semeste	r		Winter/II semester of									
ourse object	ives		s to enhances the students				_			hodol		
		ncluding theory of science and qualitative and quantitative methods in research.										
		2. The course seeks to enhance the students' skills for developing critical thinking through										
		esearch literature review in different domain. Consequently, it aims to develop skills for										
		F -	preparation of a research proposal for a master' thesis project/Mini research.  3. To develop Students competency in planning, conducting, evaluating and presenting									
		_	udents competency in pl	lannınş	g, cond	lucting,	evalu	atıng	and pre	esentii		
601		research project.	1 ' 1 - 1 1 CD	1	41 1							
CO1			basic knowledge of Research									
CO2			the knowledge of Researce to gain the Skill question									
CO3								on Du				
CO4		Knowledge on diff		ge or t	of basic Report/dissertation Procedure					•		
		Cont		CII		Lagun	ina O			I/I		
Jnit no I	Resear			<b>CH</b> 2	Had		Learning Outcome research			1,		
		ig and objectives	2		nodolog			ations,	1,			
		•	gnificance of research,		type	_	gnifica		good			
		of good research.				_		efining				
		_	of research problem,			arch pro			·g			
		ity of defining resea	•		research problems.							
			g and need of research	4	Mas	ter	researc	h	design	1,		
		-	good design, different						ethods,	,		
	researc	h designs, Sampl	ing Design- steps in		_	riment	_	esign,	and			
	sampli	ng design, Sampl	e Size determination,		vario	ous AN	OVA a	and fa	actorial			
	criteria	for selecting a sar		desi	gns.							
		of sampling design										
		oles of Design of E										
		A, Two- Way A										
		2, 23 Factorial Des										
			data collection, tools of	3					lection	1,		
			, ordinal, interval and construction and			nods,	scale	-	survey			
	ratio–	Attitude scale			uments			tistical				
		_	es, semantic differential n statistical analysis,		anal	ysis stionnai	for	re	esearch			
			ews preparation and		ques	otioiiiiai	105.					
			opment of survey									
	instrun	·										
		onnaire	,									
			research report, Format	3	Mas	ter	researc	h	report	1,		
			erent steps of writing						vriting,	,		
		-	esearch report, how to		_	_		_	ethods,			
	organiz	ze thesis/Disserta	tion, mechanics of		and	bibliog	raphy p	repar	ation.			
	_	_	standard methods of									
	quoting	ing- presenting the result, written and oral rts, Uses of abstract, format of research										
	_											
	_	_	tatistics - tabular and									
			uses of references,									
			tion of bibliography									
			ht (IPR), Introduction	3		erstand			ncepts,	1,		
	1 .1	ne need for IPR		Loloh	al and	Indian	frame	works				

	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, trademarks, and key case studies.	
	patents			
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			L HUMAN VALUES (UI									
Course co	de	23UUHV101R	Total credits: 2	L	T	P	S	R	O/F	C		
		270	Total hours:15T+30P	1	0	2	0	0	VALUE aspiration owards anderstand the standers and the s	2		
Pre-requisi		Nil	Co-requisite	L.,			Nil					
Programn		-	Master of Scien									
Semester	•		inter/II semester of First						IX 7 A T T I	EGI 1		
Course	_	1. To help the students appreciate the essential complementarily between 'VALUES' and										
objective	S	'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										
		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										
		_	and the rest of Existence.		-					_		
		<u> </u>	alues and movement towar			_	-					
			le implications of such a H				-		-	ıl humar		
			d mutually fulfilling huma				_					
		with Nature.										
CO1		The methodology of thi	s course is explorational	and t	hus un	iversall	y ada _l	otable	e. It in	volves a		
		-	tudy of the human being vi	s-à-vis	s the res	st of ex	istence					
CO2		It is free from any dogma										
CO3		_	vestigation and self-explor			-	_					
		found as truth or reality is stated as a proposal and the students are facilitated to verify it in their										
601		own right, based on their Natural Acceptance and subsequent Experiential Validation.										
CO4		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										
COF										1		
CO5		beliefs.	o enables them to critical	iy eva	iuate tr	ieir pre	-conai	tioni	ngs and	presen		
Unit		beliefs.	Conte	nt								
I	•	Understanding the t	need, basic guidelines, cont		d proce	es for V	Zalue I	Educe	ation			
-	•	•	•		-					erientia		
		Self-Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration										
	•	Continuous Happiness and Prosperity- A look at basic Human Aspirations										
	•	Right understanding, Relationship and Physical Facilities- the basic requirements for										
		fulfilment of aspirations of every human being with their correct priority.										
	•	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	•	Understandinghun	nanbeingasaco-existenceof	thesen	tient'I'	andther	nateria	1 'Bo	dy'			
	•	Understanding the	needs of Self ('I') and 'Bo	dy' - 2	Sukh an	d Suvia	lha					
	•	Understanding the	Body as an instrument of	I' (I b	eing th	e doer,	seer ar	ıd en	joyer)			
	•	_	characteristics and activiti				•					
	•		harmony of I with the Boo		nyam a	nd <i>Swa</i>	sthya;	corre	ect appr	aisal of		
			eaning of Prosperity in deta									
	•	=	re Sanyam and Swasthya-	Practi	ce Exe	rcises a	and Ca	ise S	tudies	will be		
		taken up in Practic		•	. 01							
III	•	_	nony in the family – the ba							c :		
	•	_	es in human-human relatio	onship	; meani	ng of N	Nyaya	and p	orogran	1 for its		
		fulfilment to ensur		fa 1	lation - 1	1	of ==1	tion	his			
	•		d Respect (Samman) as the						_	ā		
	•	_	neaning of Vishwas; Diffe neaning of Samman, Diffe						-			
		other salient value	-	rence	DELWEE	n respe	oi and	ulli	n emual	on, me		
			s in relationship narmony in the society (soc	iety k	eina an	extens	ion of	famil	v). San	nadhan		
		_	Sah-astitva as comprehens:	-	_		1011 01	1411111	y j. Sall	iauliali,		
	•	=	rsal harmonious order in				Societ	v (A	khand !	Samai)		
	1 -		IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		, 0114			<i>,</i> (4 t		<i>j</i> ,		

# 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 allpervasive 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

# Guidelines and Content for Practice Sessions

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

At the level of society: as mutually enriching institutions and organizations

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

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.
- 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	C	OMMU	UNICATION MASTERY	(Com	munic	ative E	nglish d	& So	ft Skil	ls)	
Course code	23UMPD12	21R	Total credits: 2	L	T	P	S	R	O/f		C
			Total hours: 15T+30P	1	0	2	0	0	0		2
Pre-requisite	<b>22UMPD1</b>	11R	Co-requisite	Nil							
	Effective E										
programme	Master of S	Science	<u> </u>								
Semester			Winter/II semester of F	•							
Course objectives		To familiarize students with the transformation of sentences and the appropriate use of									
		prepositions.									
			e writing skills in different			_				_	
		-	aning by reinforcing, substi	_			_				cation.
			nd performance boosting ac			rofessio	nal goa	ıl ach	ievem	ent.	
CO1			nar will polish their writing								
CO2			eir communication and inte								
CO3			ehavioural skills, thoughts	, and	emoti	ons wil	l enabl	e the	m to	behav	ve in a
			productive way.								
CO4			tive impact in their thought	proce	ess and	problen	n-solvii	ng sk	ills.		
Unit	Con										
Module 1-	I		of Prepositions								
Grammar	II	_	Tag questions								
	III		Idioms, Phrases and Clauses								
	IV		ple, complex, compound se	entenc	es						
Module 2-	I		ive and Passive Voice								
Grammar	II		ect and Indirect Speech								
Module 3-	I		Basics of Writing; avoid a	mbigu	ity and	l vaguer	ness				
Writing Skills			ngraph Writing								
	III		eis Writing								
	IV		er Writing								
35.11.4	V		ume, CV and Cover Letter								
Module 4-	I		OT Analysis								
Self-Manageme Skills			Regulation- Goal Setting								
	III I		sonal Hygiene	antion	& Day	lu I ana	110.00				
Module 5- Non- Verbal	II		at is Non-Verbal Communi ments of Communication,	cation	а во	iy Lang	uage,				
Communication			es of Body Language,								
Sciences of Boo			ortance and Impact of Bod	v I and	മ്പാരനു						
Language	V V	-	es of Communication throu	•		าดแลตค					
Language	VI		oduction to Haptic, Introdu	_	-						
	VII		oduction to Proxemics,								
	VIII. Body Language Do's and Don'ts, Doubt Clearing Session.										
Module 6- Grou			ortance,	, -							
Discussion (Theo	-	-	nning, Elements, and Skills	assess	sed;						
	III		ectively disagreeing,		,						
	IV		ating, Summarizing and At	tainin	g the C	bjective	e				
	1	. 11116.	, Sammarizing und 110		5	Journ					

### 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, January2019.

# **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	23MSCE121R	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	any					
Semester		Winter/II semester of I	First ye	ar of t	he prog	ramme	9			
<b>Course objectives</b>	As per the course op	ted.								
Course outcomes	urse 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:

 $\underline{https://www.coursera.org/programs/assam-downtown-university-on-coursera\ rzqtn?currentTab=CATALOG}$ 

	SEMESTER – III										
Course Title	MOOCS-III										
Course code	23MSCE211R	Total credits: 2	L	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	ıny						
Semester		Fall/ III Semester o	f 2 nd ye	ar of tl	ne prog	ram					
Course objectives	As per the course opt	ted.									
Course outcomes	As per the course o	As per the course opted.									
Course description	As per the online mar	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:

 $\underline{https://www.coursera.org/programs/assam-downtown-university-on-coursera\ rzqtn?currentTab=CATALOG}$ 

	SEMESTER – III										
Course Title	MOOCS - IV										
Course code	23MSCE212R	Total credits: 2	L T P S R O/F								
		<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	ne 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									

Teaching Objective	As per the course opted
Learning Outcomes/Course Outcome	As per the course opted

As per the online material available.

### Reference:

https://www.coursera.org/programs/assam-downtown-university-on-coursera rzqtn?currentTab=CATALOG

			Semes	ter III								
Course	title	Т	echno-Profession	ıal Ski	lls II (E	Bio fert	ilizer p	roduc	tion)			
Course	code	23MSBT211R	R Total credits: 2 L T P S R C					O/F	C			
			Total hours:	60P	0	0	4	0	0	0	2	
Pre-requ	Pre-requisite Nil Co-requisite NA											
Progran	nme			MS	c. Bota	ny						
Semest	ter		Fall/ III Sem	ester o	of 2 nd yo	ear of t	the pro	gram				
Course Obj	ectives	1. Appreciate the agr	onomic important	ce of b	eneficia	ıl micro	-organ	isms.				
2. Formulate, produce and apply Bio					ilizers in a pilot scale.							
CO1 Isolate nitrogen-fixing, phosphate-solubilizing bacteria, and mycorrhizal fungi cultures.						S.						
CO2		Apply biofertilizers	effectively in pado	ly field	s, agric	ulture,	and flo	ricultu	re ap	plicatior	ıs.	
CO3	i	Gain practical skills	in commercial bio	fertiliz	rtilizer production through industry visits.							
Unit no	Conte	ent		СН	Learn	ning ou	tcome				KL	
I	Isolati	on of pure cultur	e of Nitrogen	10	Isolate	e pure	culture	es of 1	nitrog	gen-fixin	g	
	fixing	, Phosphate solubiliz	ing bacteria and		bacter	ria, pho	sphate-	solubi	lizing	bacteria	a, 1,2	
	mycoł	nhrizal fungi			and m	ycorrhi	izal fun	gi.				
II	Applio	cation of biofertilizer	on paddy field,	10	Apply biofertilizers in paddy fields,							
	agricu	ltural land and floric	ulture.		agricu	ılture, a	nd flor	icultur	e effe	ectively.	1,2	
III	III Hand on training on commercial				Learn commercial biofertilizer							
	produ	ction of biofertilizer	(industry visit)		produ	ction to	echniqu	es thro	ough	hands-o	n 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	23MSBO217R	Total credits: 2	L T P S R O/F C						C		
		Total hours: 30T	2	0	0	0	0	0	2		
Pre-requisite	Nil	Co-requisite		Nil							
Programmes		Master of S	cience	in Bota	ny						
Semester		Fall/ III Semester o	f 2 nd ye	ar of tl	ne prog	ram					
<b>Course objectives</b>	As per the course opt	ed.									
Course outcomes	es 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:

https://www.coursera.org/programs/assam-downtown-university-on-coursera rzqtn?currentTab=CATALOG

			Semester-III								
Cours	se title			search	Ethics						
Cours	e code	23UMRE211R	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							
	amme			ISc. B							
	ester		Fall/ 3 rd Semester of 2 nd year of the program								
Course C	Objectives		ms to lay a foundation fo								
		_	elevant guidelines, policies, and codes relating to ethical research, as well as to provide, via								
			study of ethical theories, concepts.								
	01		o describe and apply theor								
C	02	_	an overview of importar			search	ethics	, like	e respo	nsibility for	
			nical vetting, and scientific			2 1					
	03	_	skills of presenting argume								
C	04		to Identify the concepts ar	nd prod	cedures	of sam	pling,	data	collecti	ion, analysis	
TT **		and reporting	<u> </u>					•	0 .~		
Unit no	ETHICO	T. 4 1	Content	.1		TT 1			OutCo		
I			to the course and each							ey ethical	
			theory. Ethics: definit			-	-			ories in	
			al judgements and reaction						, critica	ally o research	
	_	_	on; research ethics. Hone y. Data ownership and	-		ethics		ies re	rated to	research	
	_		llaboration. Human and		_	euncs	••				
		•	earchers in society.	11011-1	iiuiiidii						
II			F- Ethics with respect to	scienc	ee and	Unde	rstand	and a	ipply et	hical	
11			esty and research integrit								
			-	-		principles related to scientific conduct, demonstrate intellectual					
			ification, Fabrication, and Plagiarism (FFP). conduct, demonstrate tions: duplicate and overlapping publications, honesty and research in								
		_	porting and misrepresenta	_		recognize and prevent scientific					
		5				_	nisconduct				
III	PUBLICA	TION ETHIC	CS- Publication ethics:	defi	nition,			the in	nportai	nce of	
	introductio	n and importan	ice. Best practices / stand	dards	setting				-	gnize best	
		_	: COPE, WAME, etc.		_	_	ces and		_		
	interest. Pu	ublication misc	onduct: definition, concep	pt, pro	blems						
			viour and vice versa, type								
			authorship and contri								
			ation misconduct, com	plaints	s and						
		• •	ers and journals.								
IV			SHING-Open access publ						oncept		
			E0 online resource to che	_		_		of o	pen acc	ess	
	1 1 0		g policies. Software tool		•	publis	shing				
		_	eveloped by SPPU. Jour								
			viz. JANE, Elsevier Jou	irnai F	inder,						
<b>T</b> 7		ournal Suggester		om =: C	٠ <b>اد</b> : - ٠4	C-:	C	.i.e.	. :	marri = -4°	
V			NDUCT Group Discussi		_		-		-	navigating	
			FP, authorship. Conflicts			ınaex	ing and	ı cıta	uon da	tabases	
	_		examples and fraud from								
			e of plagiarism software larce software tools.	ike i u	1111UIII,						
		_	ESEARCH METRICS	L_Data	haces						
			on databases: Web of Scie								
	_		pact Factor of journal as		-						
			R, IPP, Cite Score. Metric	-							
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- 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:

 $\frac{https://researcheracademy.elsevier.com/uploads/2018-02/ethics \ a5 \ booklet \ update 260617 \ web.pdf}{https://researcheracademy.elsevier.com/publication-process/ethics}$ 

	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

	Semester- III											
Cour	se title		Personal fina	ncial p	lann	ing						
Cours	se code	23UUFL202R	Total credits: 1		L	T	P	S	R	O/F	C	
			Total hours: 30P	•	0	0	2	0	0	0	1	
Pre- re	equisite	22UUFL201R	Co-requisite		Nil							
		Introduction to Financial										
		Budgeting And Planning										
Progr	ammes	Bachelor of Business Ad	ministration/Bac	helor o	of Ho	otel	Man	agem	ent a	and C	atering	
		Technology/Bachelor of	Technology/Bachelor of Business Administration (I)/Bachelor of Business									
		Administration (Industry	Integrated)/Bach	elor o	f So	cial	Wor	k/Bac	chelo	or of A	Arts in	
		Sociology/Bachelor of Ma			ny							
Sem	ester	Fall/ 3 rd Semester of 2 nd y										
		1. The course would offer									oncepts	
		of money, borrowing, lend	•	• •					•	_		
Co	urse	2. Assess the personal fina	ancial planning p	rocess,	the 1	ife c	ycle	of fin	nanci	ial pla	ns, and	
Obje	ectives	methods of goal achievem										
		3. Formulate a budget, re	ecord-keeping sy	stem,	and 1	tax p	olann	ing s	trate	gy ba	sed on	
		current financial goals.										
	01	Explain the cash managem							iles.			
	O2	Discuss a diversified inves	_									
	O3	Compare mutual funds, E						S.				
	O4	Develop a financial plan for										
C	O5	Describe financial product		or long	g-tern	n go	als					
Unit no		Content	Contact Hour		Lea	arnii	ng O	utcoı	me		KL	
	I∣nit 1_ I	Fundamentals of Financia									2,3	
											Z.J	
			1								2,3	
	Planning	g –	ning,								2,3	
	Planning Function	g – s of money; Inflation- Mea	ning,	C. 1		.11 1	11				۷,3	
I	Planning Function causes, h	g –	ning,	Studer					ntale		۷,3	
I	Planning Function causes, h official p	g – s of money; Inflation- Mea ow it can be controlled; pro	ning,	compr	ehen	d the	fun		ntals		2,3	
I	Planning Function causes, h official p simple an	g – s of money; Inflation- Mea ow it can be controlled; pro lanning, Time value of mon	ning, ocess ney-		ehen	d the	fun		ntals		۷,3	
I	Planning Function causes, h official p simple an Present V	g – s of money; Inflation- Mean ow it can be controlled; pro- lanning, Time value of mon nd compound interest; Net	ning, ocess 6 ney- wer of	compr	ehen	d the	fun		ntals		2,3	
I	Planning Function causes, h official p simple an Present V	g – s of money; Inflation- Meanow it can be controlled; pro- lanning, Time value of mond compound interest; Net	ning, ocess 6 ney- wer of	compr	ehen	d the	fun		ntals		2,3	
I	Planning Function causes, h official p simple an Present V Compound	g – s of money; Inflation- Meanow it can be controlled; pro- lanning, Time value of mond compound interest; Net	ning, ocess 6 ney- wer of	compr	ehen ial pl	d the	e fund ng.	dame		of	1,2	
I	Planning Function causes, h official p simple an Present V Compoun of 72. Unit 2- I	g – s of money; Inflation- Mean ow it can be controlled; pro- lanning, Time value of mon nd compound interest; Net Value and Future value, Pow nding; Doubling period and	ning, ocess ney- wer of I Rule	compr financ	ehen ial pl	d the anni	e funding.	dame	nder	stand		
I	Planning Function causes, h official p simple an Present V Compoun of 72. Unit 2- I Meaning	s of money; Inflation- Mean ow it can be controlled; pro- lanning, Time value of mon- nd compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning—	ning, ocess 6 ney- wer of I Rule 6	compr financ Studer and ut	ehen ial pl nts w ilise	d the lanni	e funding.	to u	nder	stand		
I	Planning Function causes, h official p simple an Present V Compoun of 72. Unit 2- I Meaning Taxes, T Income f	s of money; Inflation- Mean ow it can be controlled; pro- lanning, Time value of mon- nd compound interest; Net Value and Future value, Pow- nding; Doubling period and ncome Tax Planning— of Income, Direct & Indire	ning, ocess 6 ney- wer of I Rule 6 ect ds of	compr financ	ehen ial pl nts w ilise	d the lanni	e funding.	to u	nder	stand		
	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- Mean ow it can be controlled; pro- lanning, Time value of mon- nd compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heafor tax Calculation, Non-tax	ning, ocess 6 ney- wer of I Rule 6 ect ds of	compr financ Studer and ut	ehen ial pl nts w ilise	d the lanni	e funding.	to u	nder	stand		
	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- Mean ow it can be controlled; pro- lanning, Time value of mon- nd compound interest; Net Value and Future value, Pown ding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various head for tax Calculation, Non-tax	ning, ocess 6 ney- wer of I Rule 6 ect ds of	compr financ Studer and ut	ehen ial pl nts w ilise	d the lanni	e funding.	to u	nder	stand		
	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- Mean ow it can be controlled; pro- lanning, Time value of mon- nd compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various head for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.	ning, ocess 6 ney- wer of I Rule 6 ect ds of cable	Studer and ut incom	ehen ial pl nts w ilise e tax	ill be	e funding.	e to u	nder	s of stand	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	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heaf or tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.	ning, ocess 6 ney- wer of I Rule 6 ect ds of cable	Studer and ut incom	ehennial pl	d the	e funding.	e to u aspec	nder	s of stand	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. Meaning	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of moned compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heat for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning of Entrepreneurship,	ning, ocess 6 ney- wer of I Rule 6 ect ds of cable	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heaf or tax Calculation, Non-tax vasion and tax avoidance, Fax Planning Strategies.  Entrepreneurial planning and of Entrepreneurship, sites for becoming an	ning, ocess 6 ney- wer of I Rule 6 ect ds of cable	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heat for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning of Entrepreneurship, sites for becoming an neur,	ning, ocess ney- wer of I Rule  6 ect ds of cable	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heaf or tax Calculation, Non-tax vasion and tax avoidance, Fax Planning Strategies.  Entrepreneurial planning and of Entrepreneurship, sites for becoming an	ning, ocess ney- wer of I Rule  6 ect ds of cable	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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,	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heat for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning and of Entrepreneurship, sites for becoming an ineur, oreneurship Support System	ning, ocess ney- wer of I Rule  6 ect ds of table  - 6	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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- Mean ow it can be controlled; prolanning, Time value of money and compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heafor tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning and of Entrepreneurship, sites for becoming an neur, oreneurship Support System attional support systems for	ning, ocess ney- wer of I Rule  6 ect ds of table  - 6	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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. Institt entreprer	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of moned compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various hear for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning and of Entrepreneurship, sites for becoming an neur, oreneurship Support System attional support systems for neurs,	ning, ocess ney- wer of I Rule  6 ect ds of table  - 6	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand 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. Institt entreprer	s of money; Inflation- Mean ow it can be controlled; prolanning, Time value of mond compound interest; Net Value and Future value, Pownding; Doubling period and ncome Tax Planning— of Income, Direct & Indirect axable Income, various heat for tax Calculation, Non-tax vasion and tax avoidance, Tax Planning Strategies.  Entrepreneurial planning of Entrepreneurship, sites for becoming an neur, oreneurship Support System attional support systems for neurs, cial support systems for neurs,	ning, ocess ney- wer of I Rule  6 ect ds of table  - 6	Studer and ut incom	ehennial pl	d the danni	e funding.  e able assic GST	e to u aspect.	nder	stand f	1,2	

	v. Vantuma Canital Dusiness August			
	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 –		and interpret the different	
	i. Investment avenues offered by		dimensions of stock market	
	Securities Markets,. Primary Market and		investment.	
	Secondary Market,			
	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 4	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;			
	iii. Housing Decision: Factors and			
V	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.			
	riaming, wins.			

- 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	e	Corporate proficie	ncy						
Course coo	le 23UMPD211R	Total credits: 2	L	Т	P	S	R	O/F	С
		Total hours: 60P	0	0	4	0	0	0	2
Pre-requisi	te 22UMPD121R Commun	ication Co-requisite	NA						
_	Mastery								
Programm	es	MSc. Botany	-						
Semester	Fa	ll/ 3 rd Semester of 2 nd year	of the	pro	gran	1			
Course	1. To acquaint students	with the various tools of an o	effect	ive p	resei	ntatio	n.		
Objective	s 2. To acquire the spea	aking skill, instruct, influen	ce, e	ngag	e, e	ducat	e, or	appea	se the
	listeners.								
	_	ncy, present ability and quality	-	resur	ne ai	nd pr	ovide	guidar	ice for
	^	self-evaluation in social medi							
		the students for the campus of							
CO1		s to speak with greater control							s.
CO2		pact in their thought process					-		
CO3		with all the necessary tools	and s	sk1ll	sets	to pr	epare	e profes	ssiona
CO4	resume.	1.4 1	1	1	• .				
CO4		tht and assess themselves in s				:		.: 1	
CO5		techniques to solve critical ews, improve their communication							
Unit no	strategies to crack intervi	Content	zatioi	1 SKII	18, 00	JOSE I	пеп	commue	lice
I	<b>Module 1- Presentation S</b>								
1	i. Introduction	XIIIS							
	ii. Essential characteristics	of a good presentation							
	iii. Preparation of a good pr	-							
II	Module 2- Public Skills								
	i. Fear of Public Speaking,								
		coming Fear of Public Speak	ing,						
	iii. Confidence and Control								
	iv. Physiology and Stress -	Control/Process,							
	v. Tips for Presentations an	d Public Speaking,							
	vi. Tips for Using Visual A								
	vii. Process for Preparing a								
	viii. Delivering Presentation								
	ix. Doubt Clearing and Sun	<u> </u>		<b>78</b> .	***	••		•	
III		ion on Resume, Curricult	ım V	itae,	, Wi	iting	cov	er lett	er &
	LinkedIn Profile	P							
	<ul><li>i. Preparation, submission &amp;</li><li>ii. Practical session on cover</li></ul>								
	iii. Creating a profile on Li								
	iv. How to utilize it	incum							
	Module 4- Leadership &	Management Skills							
	i. Concepts of Leadership,								
	ii. Leadership Styles,								
	iii. Manager VS Leader,								
	iv. How to be an Effective	Leader,							
	v. Mock/ Practice Session,								
	vi. Doubt Clearing Session								
IV	<b>Module 5- Research Pape</b>	r – Writing Skills							
	i. How to write a research p	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,

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

ii. Feedback- Receiving Feedback,

iv. Advantages of Effective Feedback,v. How to deal with negative feedback.

iii. Giving Feedback,

### **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	23MSBO212R	Total credits: 2	L	T	P	S	R	O/f	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	<b>'</b>	Winter/II semester of I	First y	ear of	f the pi	ograi	nme		
Course	1. To determine w	whether the objectives	of rev	iew of	f literat	ture g	ap ai	nalysis	have been
objectives	met, if not what ste	eps can be taken accord	ingly.						
CO1	Create and imple	ement a plan to bridge th	ne gap						
CO2	Find the gap and e	valuate solutions.							
CO3	Identify the ideal f	uture state/action plan							
CO4	To analyse the curr	rent state/work of resear	rch						
CO5	To implement the	strategies to meet the re	search	gap u	ınder sı	ipervi	sion.		

SEMESTER – III											
Co	urse Title	F	loral morphology, Embryo	ology a	nd Paly	nolog	y				
Co	urse code	23MSBO213R	Total credits: 4	L	T P	S	R	O/F	C		
	• • •	270	Total hours: 45T+30P	3	0 2	0	0	0	4		
	e-requisite	Nil	Co-requisite	· D		N	il				
	ogramme emester	I.	Master of Science			romn	10				
	se Objectives		Fall/ III semester of second year of the programme  1. To understand the origin and evolution of different parts of flowering plants.								
Cours	o objectives	2. Knowledge on developmental biology.									
		3. Understand the pollen structure and its application.									
	CO1	_	nology of a flower, include			and 1	primi	tive str	uctures.		
		and explain flower									
	CO2	Explain the structu	re and function of micro	sporan	gium, n	nega	spor	angium,	pollen		
		development (micro	osporogenesis), and sporog	enesis.							
	CO3	Describe endosperr	n types, the relationship	betwe	en endo	sperr	n an	d embr	yo, and		
		explain embryo cult	cure techniques.								
	CO4		ations of tissue culture		-	_		-			
			c modification, somatic e	mbryo	genesis,	disea	ase e	radicati	on, and		
		conservation.									
	CO5	1 1	gy, including pollen and	•	•	•			•		
			zing pollen and spore mor	rpholog	gy using	micr	osco	py and s	staining		
TT	1	methods.		CIT			-		T.7.		
Unit- No.		Conten	t	СН	Lea	ırnınş	g Out	come	KL		
I	Flower-Mo	rphology of flower.	, inflorescence. Primitive	10	Able	to (	descri	ibe and	]		
		nced structure of						e flower			
			of flower. –evolution of		and its	devel	opme	ent.	1,2		
	_	pollinator, Staminod									
II	Microspora	angium–Structure ar	nd function of wall layers,	8	Knowl	abou	t				
	Microsporo	genesis, role of C	allose and tape tum in		1						
	_	lopment, Pollen wall			megası	oran	gia.		1,2		
			ollen mitosis, Division of						1,2		
	_		in sperms, Pollen fertility								
111		erility, Pollen storage		10	A11	4	1 '	'1			
III		_	embryosac-Endospermty sperm haustoria and their	10	Able		descri	be and the pos			
	1 ~	nbryogenesis	in Monocot and		_			ges takes			
	1		Sytology and function of		place is			-	1,2		
	suspensor,	Physiological	and Morphogenetical						1,2		
		of endosperm and e	1 0								
	Embryocult	-	•								
IV	Plant Tissu	ue culture: History	, Basic aspects of plant	10	Able	to (	descri	ibe and			
	tissue cultur	re, Types of plant tis	ssue culture, and Methods		_			differen	t		
			dium (MS and White),		tissue o	cultura	al tecl	hniques.	1,2		
	_		, Cellular Totipotency,						1,2		
			Organogenesis, Somatic								
**		esis, Micropropogati		-	T.	1 .	4 .4	11			
V			ynology. Spore, pollen	7	To und and its			ie poller	1		
	morphology Evolution		ry, exineornamentation, ypes, Application of		and its	արիու	cauOl	ı.	1,2		
			ynology. Aeropalynology								
	пеорагупот	ogy and paraeopary	motogy. Actopatytiology								

	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.	
	2			

- 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:**

 $\frac{https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/embryo-plant}{https://www.sciencedirect.com/journal/review-of-palaeobotany-and-palynology}$ 

	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	1.0.6				
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,	125				
4	including micro propagation, genetic modification, somatic	1,3,7				
	embryogenesis, disease eradication, and conservation.					
5	Describe palynology, including pollen and spore morphology,	124				
	chemistry, and techniques for analyzing pollen and spore	1,3,4				
	morphology using microscopy and staining methods.					

	SEMESTER – III										
Course		Economic botany, ethnobotany and pharmacogno					cogno	sy			
Course code		23MSBO214R	Total credi		L	T	P	S	R	O/F	C
Pre-requisite		Nil	Total hours: 4		OP 3 0 2 0 0 0 4 Nil						4
Progra		INII	Co-requisite Nil  Master of Science in Botany								
Seme		Fall	Fall/ III semester of second year of the programme								
Course Ob	ojectives	1. To give knowledge									
		2. To uplift the knowledge of the students about the conventional use of medicinal									
		plant.									
		3. To give knowledge to the students about development of new drugs for safe and									
		more rational use of herbal preparations.									
CO		Student scan able to know the economically used plants.									
CO		Describe and classify									
CO		Documentation of Eth									
CO	4	Understand the need f	tor developmen	it of ne	ew drug	s for	safe	and n	nore r	atıonal ı	ise of
00	5	herbal preparations.	.:11 to 2 2 2 0	1 1 1	1	1			1	1 - 4	
CO	רי 	Develop laboratory sk	iii in testing of		arugs a					products	
Unit-No.		Content		СН		Lea	arnın	g Out	come		K L
I	Introdu	uction to Econom	ic Botany	10	Able to	desc	ribe a	and ex	plain a	bout the	
		luction to Economic Botany: 10 Able to describe and economically impo									
		of plants in relation	'= I		their ut	ility.					
		e, Importance of fo									
		tion and commerc	=								
		of origin of cultiv	-								
		centre of wild pla	=						1,		
		Botany and uses o	_						2		
		ic plants, Orname									
		lic beverage, Plant	=								
		on control: Methods									
	_	examples. Mineral									
	plants.	Manipies. Winterar	mareating								
II	Classifi	cation of Econor	nic Plants:	8	Knowle	edge	abou	ıt eco	nomic	plants'	
		cation of economical			groups.					1	
		Cereals and Millets,	• •								
	Legume	es, Vegetables, Fruit	s, Beverage-								
yielding plants, Drug-yielding plants, Narcotic-yielding plants, Fiber-yielding plants, Timber-yielding plants and Bamboos, Rubber-yielding plants, Oil-		g plants, Drug-yiel	ding plants,							1,	
											2
		•	•								
	-	g plants, Sugar-yiel	ding plants,								
111		om cultivation etc.	-4:	10	Λ 1 ₋ 1 ₋ 4	da-	nils -	and	nloin	hov4-	
III		ootany: Introdu		10	role and			-	-	bout the	
		otany, Different b			1010 and	. 300 <u>1</u>	01	- mil (	Journy	•	
		otany, Importance an	-								1,
	Ethnob	•	pal-medicine								2
		y, Role of ethno med									
	scope	in modern times	s, Role of								

	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	Course Title Plant molecular biology and biotechnology										
Cor	urse code	23MSBO215R	Total cred		L	T	P	S	R	O/F	C
	• • •	N.1+1	Total hours:		OP 3	0	2	0	0	0	4
	-requisite	Nil	Co-requ		Saiomaa i	n Dotor		N	ıl		
	ogramme emester	Master of Science in Botany  Fall/ III semester of second year of the programme									
	e Objectives	Fall/ III semester of second year of the programme  1. To introduce to rapid contemporary changes witnessed in plant molecular biology.								nlogy	
Cours	e objectives	2. To define large-scale, systems-level, and high-through put data sets to derive nov									
		biological in sights	•		_						
		3. To give students the knowledge about DNA-based technology for a wide range of									
		novel in fectious disease diagnostic techniques.									
	CO1	Describe DNA stru	ıcture, replicat	tion, an	d sequer	cing p	rincij	oles.			
	CO2	Describe RNA stru	ictures, synthe	sis, pro	cessing	includi	ng sr	nall l	RNAs.	i	
	CO3	Explain hormones,	receptors, sig	nalling	, chemo	taxis.					
	CO4	Explain the applica	ation of genetic	c engin	eering.						
	CO5	Describe the proce				nginee	red p	lants	•		
Unit-		Content		СН		Lear					KL
No.											
I	Structure	of DNA, forms a	nd function,	10	Able to				-		
		opology, DNA			structur	e of Di	NA a	nd its	funct	ions.	
		s, DNA replication									1,2
	1	g and lagging strands, DNA					,-				
	_		, polymerases & DNA								
	_	nciples of DNA seq		8	Able to describe and explain ab						
II		Structure of RNA, Synthesis and							_		
		of genetic and non-genetic structure of RNA and its function RNA, tRNA, rRNA, RNA				ions.					
			· ·								1,2
	1 *	and Processing, RN nd Polyadenylation									
	small RNA	• •	i oi ilikiva,								
III		and their rece	eptors, Cell	10	Able to	describ	e and	d exr	lain a	bout the	
111		ceptors, signaling	_	10	Able to describe and explain about the role of hormones in signal transduction.						
		coupled recepto	•					_			
	1 *	on pathways, re	, .								
		oathways, Bacterial	~								
	0 1	analysis, genetic									1,2
	Molecular	systematics and	l diagnosis,								
	Autogenou	is regulation of	ribosomal								
	protein sy	nthesis. protein	sorting and								
		ar trafficking, post	translational								
	modification										
IV		gineeringprinciples,		10	Knowle	dge of	gene	tic ei	nginee	ring.	
	1	esinvolvedinrDNAt	•								
ndlegaland		ons,intellectualprop									
		biosafetyissuesasso							1,2		
		ofDNAmarkersinge									
	1 *	genomeanalysis,ger									
	nGenome l	diagnostics,anddiag	gnosis.Huma								
V			ta Chimania	7	Tourd	retond	Con	nonta	of		1.2
V	Genetically	y engineered plan	is, Chimeric	/	To unde	istand	Con	cepts	UΙ		1,2

	DNA, DNA probes and Genomic /c DNA		genetically engineered plants.	
	libraries, chloroplast engineering, and			
	transplastomic plants. Techniques for			
	identification of diseased gene and			
	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								
Cour	rse Title	Plant ar	natomy, Micro			volut	ion				
Cour	rse code	23MSBO216R		credits:		LI		S	R 0/1		
	• • •	<b>3</b> .7*1	Total hou			3 (	2	0	0 0	4	
	equisite	Nil		requisite				Nil			
	ramme nester	Fall/ III	Master of S			aromr	<b>n</b> o				
		1. The course deals with th						11c a	nd tice	1160	
Course	-	2. To make learner unders			•						
		growth in dicots and mono		concep	or norma	and	anon	iaiot	13 3000	ildai y	
		3. To impart concept of micro techniques and evolution.									
	C <b>O</b> 1	Describe meristems, vascular cambium, their types and factors affecting cambial									
		activity.									
	CO2	Explain vascular tissues its origin, structure, development, and ontogeny, compare									
		reaction wood, distinctions between heartwood and sapwood, and identify and classify									
		he plant specimen by assessing their anomalous secondary growth.									
	CO3	Describe leaf ontogeny, va						stock	ronic	index	
		and describe transfer cells,		•			•				
	C <b>O</b> 4				_					s, and	
		Prepare specimens using microtome, maceration, squash, and clearing techniques, and assess.									
	C <b>O</b> 5	Explain the theories of evo	xplain the theories of evolution.								
Unit-		Content		СН	Lea	rning	Outc	ome		K	
No.										L	
I	Meristen	ns-characters, classific	ation and	10	Able to o	lescri	oe ar	nd e	xplain		
	theories-	-Apical cell theory,	Tunica-		about plan	nt cel	l stru	ıctuı	e 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				_		
	•	nd phloem. Reaction wood-			about stru			cond	ucting	1,	
	1	es. Heart wood and sapw	- 1		tissues in p	olants	•			2	
	1 .	grains, texture and defects									
***		y growth in Dicots and Mo		1.0	77 1 1		1 0		<i>α</i> 1		
III		geny-initiation, apical,	intercalary,	10	Knowledg			and	floral		
	_	andadaxial growth, plate			anatomy o	f plan	ts.				
		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	n. 1 mili galls,								
IV		on, squash and clearing	techniques	10	Able to o	lescril	ne ar	nd e	xnlain		
		preparation for light			about the				_		
	_	ation of fixatives, formu			hand clear				- 1445	1,	
		on for light microscop	- 1			5 :0		•		2	
	dehydrat		procedures.								
		nes: Rotary, sliding, cryosta	•								
V		evolution, Darwinism, La		7	To unders	tand C	Conce	ptsc	of	1,	
	Neo Dar		• /		evolution			-		2	
Pract	1. Study	of anomalous secondar	y growth of	30			expla	in	and	1,	
ical		families of Angiosperms.	-		demonstra		-		fferent		

2. Preparation of microtome block, Preparation	techniques of anatomy a	ınd	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						
Z	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						
	Explain the dicolles of evolution.							

SEMESTER - IV									
Course Title		Research/data ana	alysis/	docur	nentat	ion-R	4		
Course code	23MSBO221R	Total credits: 13	L T P S R O/F					C	
		Total hours: 40P	0	0	20	8	6	0	13
Pre-requisite	Nil	Co-requisite		•	•	N	il		
Programme		Master of Science in Botany							
Semester	<b>'</b>	Winter/II semester of First year of the programme							
Course	1. To determine v	whether the objectives	of rev	view c	of litera	ture g	gap	analysi	s have been
objectives	met, if not what ste	eps can be taken accore	dingly	·.					
CO1	Create and imple	ement a plan to bridge	the ga	p					
CO2	Find the gap and e	valuate solutions.							
CO3	Identify the ideal f	uture state/action plan							
CO4	To analyse the cur	rent state/work of research	arch						
CO5	To implement the	strategies to meet the r	esearc	h gap	under	super	visio	n.	

	SEMESTER – IV												
	urse Title			Angiosperm	n taxono	omy-I							
Co	urse code	23MSBO222R	l .	credits: 4	L	T	P	S	R	O/F	С		
				ırs: 45T+30P	3	0	2	0	0	0	4		
	e-requisite	Nil		requisite	<u> </u>	<b>.</b> .		Nil	<u> </u>				
	ogramme	_		Master of Sci			•						
	emester			emester of Fin						• • • •	. 1		
Cours	se Objectives	1. To study the fun	idamentai	concept of flo	owering	g pian	its for	prop	er cla	ssificati	ion and		
		identification.  2. Field visit help students to study the flowering plants and identify up to the genus											
			students to	study the Ho	owering	g pian	is and	i iden	itiry u	p to the	e genus		
		level.  3. By visiting field students can gather knowledge about the ethnobotanical use of											
		•		can gather k	cnowiec	ige at	out t	ne et	nnobe	otanicai	use of		
		plants by local p			, 1	, .	٠,	,	i	. ,.	1'1		
		4. To learn about				nts vi	sit re	searc	n orga	anisatio	ns like		
		BSI, NBRI, FRI	•		_	DI.	Б	1 .1					
		5. Students can app			snips ic	or Ph.	D. an	a oth	er nig	ner deg	grees in		
	G04	plant taxonomy			• 1	.•	C 1						
	CO1	Explain the princip					•				•		
	CO2	Describe botanica	ıı keys, t	axonomic li	terature	e met	tnods,	and	con	nputer-a	ıssısted		
	G02		identification.										
	CO3	Explain botanical nomenclature principles, rules, priority, effective publication, and											
		related terms.			1 111					. 10			
	Prepare herbarium, dis			_			s, and	the	Botan	ical Su	rvey of		
India, their significance in l					_								
	CO5	Explain OTUs,		•							nalysis,		
<b>T</b> T •.	T	dendrogram/ clado	gram cons						eing m	nethods			
Unit- No.	Content			СН	Learni	ing Oi	itcom	e			KL		
I	Basics of T	Taxonomy: Aims, o	objective	10	Know	ledge		of	di	fferent			
		les. Pre and Post D				_		tems	and co	oncept			
		ons, Phenetic, Phylo			of cha					•			
		nd APG System, A	_										
	Omega	•	xonomic										
	hierarchy,	Concept of species	s, genus,										
		l infra-specific ca	-								1,2		
	1 7	of Characters–Qu	_										
	_	tative characters, G											
	1 -	ters, analytical and											
		conservative charac	-										
		characters, Isolat											
	1	of characters.											
II	_	Γ <b>axonomy:</b> Botanio	cal keys-	8	To lea	ırn th	e bas	ics of	f taxo	nomy,			
		keys, multi-acces	-				ootani		keys	•			
	_	pattern recognition	-		taxono	omic 1	iteratı	ıre.	,				
		ication Punched Ca											
		literature-Preparat									1.2		
		n of data in floras,									1,2		
	_	a, manuals, mon											
	-	icons, journals and											
		an noted list, rev											
		puter in identificati	-										
	presentation poor flora revisions, i Checklist,	n of data in floras, a, manuals, mon icons, journals and an noted list, rev	rich and lographs, d others.								1,2		

III	<b>Botanical Nomenclature</b> : Principles	10	To know about the nomenclature	
1111	and major rules, typification, rule of	10	of plants.	
	priority, effective and valid		of plants.	
	publication, retention, choice and			
	rejection of names, illegimate names,			
				1,2
	Authors' citation, synonym, basionym,			
	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		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			
	library- Function and role			
	intaxonomic studies. <b>Botanical</b>			
	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,			
	construction of Dendrograms and			1,2
	cladograms, basic of bio informatics,			
	biological databases, data search,			
	sequencing methods.			
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			
	morphology, (b) Anatomy, (c)			
	Cytology, (d) Palynology (e)			
	Chemotaxonomy.			
	3. Practices on Nomenclatural			
	problems by handling of floras,			
	1 -			
	manuals, icons and index kewensis etc.			
	4. Handling of taxonomic softwares.			

- 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 computer-assisted identification.	1, 2, 6							
3	Explain botanical nomenclature principles, rules, priority, effective publication, and related terms.	1, 2, 6							
4	Prepare herbarium; discuss botanical gardens, libraries, and the Botanical Survey of India, their significance in knowing plant species.	1, 3							
5	Explain OTUs, character coding, resemblance measures, cluster analysis, dendrogram/ cladogram construction, bioinformatics, and sequencing methods.	1, 2, 6							

SEMESTER – IV												
	urse Title			giospe	rm tax	onom	y-II			1		
Cor	urse code	23MSBO223R	Total credit		L	T	P	S	R	O/F	C	
			Total hours:		2	0	0	0	0	0	2	
	-requisite	Nil	Co-requisi					Ni	<u>l</u>			
	ogramme			ter of S			•					
	emester		Winter/II seme							<b>.</b>	/ · 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										
										re impo	rtant ın	
		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 ph	ytogeography	studen	its can	able	to kno	ow abo	out the	e differe	nces of	
		plants pecies in different geographical zones.										
		4. By studying for	orest types stu	dents	can al	ble to	knov	v abou	at the	differer	nt plant	
		species distribu	ted in different	types	of fore	ests.						
	CO1	Describe taxonom	ic evidences, n	nolecu	lar tax	onom	y, dia	gnosti	c tools	, PCR a	nalysis,	
		and applications of										
	CO2	Explain angiosper	m origin, chara	acterist	tics, ar	nd evo	olution	, as w	ell as	ethno bo	otanical	
		Explain angiosperm origin, characteristics, and evolution, as well as ethno botanical uses concerning North-East tribes.										
	CO3	Describe North East India's flora, endangered plant conservation, and sustainable										
		forest management.										
	CO4	Explain phytogeog	graphy, India's	biodiv	ersity,	migra	ation, a	and pla	ant doi	mesticat	ion.	
	CO5	Explain phylogen			-	_		_				
		and monocotyledo			0 1				Ü	•		
Unit-	Content	· · · · · · · · · · · · · · · · · · ·		СН	Lear	ning (	Outcon	ne			KL	
No.												
I	Sources	of taxonomic	evidences:	10		_				onomic		
	Morpholog	•	Palynology,				_	_		fication		
		mbryology, Cytolo			and o	classif	fication	n of ar	igiospo	erms.		
	Chemotaxo	nomy, Phytochemia	stry, Serology									
	Biosystema		•								1,2	
		plant taxonomy,	_									
		• •	plication of									
		narkers in plant tax	•									
		ance of molecular to										
II	0	nd evolution-	Origin of	8		_	_			gin and		
		s with special refe			evolu	ıtion (	of ang	iosper	ms.			
		tock, Characteristic										
	Primitive	and advanced	angiosperms,									
		y trends in Angios	perms. Cradle								1,2	
	of flowering	- 1										
		ny-Use of plants	•									
		in North-Eastern										
		, medicine and cult										
III		<b>oes</b> -Flora and for		10						ypes of		
		India, RET plants			Nort			India	and	their		
	•	rence to NE India.			cons	ervati	on stra	ategies			1,2	
	_	er plants and the									1,2	
	endemic,	exotic, alien and	d introduced									
	elements in	North East flora.	Bio 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. SinghandD. K. Jain, RastogiPublication, 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	1, 2						
1	tools, PCR analysis, and applications of molecular markers.	1, 2						
2	Explain angiosperm origin, characteristics, and evolution, as well as	1, 2, 6						
	ethno botanical uses concerning North-East tribes.	1, 2, 0						
3	Describe North East India's flora, endangered plant conservation, and	1, 2, 6						
3	sustainable forest management.	1, 2, 0						
4	Explain phytogeography, India's biodiversity, migration, and plant	1 2						
4	domestication.	1,3						
5	Explain phylogeny and evolution of Angiospermic taxa, covering	1 2 6						
3	key dicotyledons and monocotyledons.	1, 2, 6						

			SEMESTER – IV									
Cou	ırse Title		Microbio	ology-I								
Cou	irse code	23MSBO222R	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					
	gramme		Master of Scien		•							
	mester	Winter/II semester of First year of the programme										
Course	Objectives	. The course deals with the microbial ecology, diversity of microorganisms in soil,										
		water and air.  To make learner understand about the application of microorganisms in agriculture										
			and industry.									
		and industry.  3. The course deals with microorganisms involve in the food industry.										
	CO1		teractions, microbes in e					лу.				
	CO2		eteristics, isolate, identif					resent	soil ai	r and		
			rate the method of bacte	•	•		•					
		activity of microbes				. J 2 1		,				
	CO3	· ·	application in agriculture	for cr	op pro	ducti	on.					
	CO4		application in industr					eutica	ls, food	land		
		beverage and bio fu		•	J	1						
	CO5	~	biology, food safely, pre	eservat	ion, an	ıd qu	ality	of pro	ducts.			
Unit-		Content	;	СН	]	Lear	ning (	Outcor	me	K		
No.										L		
I	Microbial	0,5		10	Knov	•	-		icrobial			
			etion with plants and		intera			with	other			
	1		with xenobiotics and		orgar	nisms	S.			1,2		
	inorganic	pollutants, Micr	robes of extremeen									
	vironment		1: '4 ' '1 '1	0	T	1	41	1	·			
II			diversity in soil, soil composition of organic	8					ics of in soil,			
			quantify soil microbes,		water			isity	111 8011,			
			to monitor soil health		Water	and	an.					
	and toxicit		to momitor son nearth									
			ere and phylloplane,							1,2		
			r, allergic disorders by							1,2		
		lora, sampling techni	•									
			components of water,									
			er in municipal water									
		cteriological analysis	*									
III			griculturally Important	10	То	kno	w	abou	t the			
	microbes,	biological N ₂	fixation, phosphate		agric	ultur	al mi	crobio	ology.			
	solubilizat	tion, PGPRs, rhiz	cosphere, Mycorrhiza,							1,2		
	Biofertiliz	ers, Crop diseases	caused by different									
	pathogens	, Bio-control of plan	t diseases.									
IV	Industrial	Microbiology-Ind	ustrial importance of	10	To u	nders	stand	the ba	asics of			
	micro	organisms, Ferr	mentation process,		indus	strial	micr	obiolo	gy.			
	bioreacto	rs, isolation,	preservation and									
			nicrobes, downstream							1,2		
	processin		protein, Industrial									
	1 -	-	, antibiotics, ethanol,									
	_	and amino acids.	,, 3									
<u></u>	v radiffilis	and annino acids.		ļ	<u> </u>							

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			
			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			,5, 4		
	3. Detection of organic acids produced by fungi by					
	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/C https://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	1, 3, 4, 6						
	computer-assisted identification.	1,0,1,0						
3	Explain botanical nomenclature principles, rules, priority, effective	1, 2, 3, 6						
	publication, and related terms.	1, 2, 3, 0						
	Prepare herbarium, discuss botanical gardens, libraries, and the							
4	Botanical Survey of India, their significance in knowing plant	1, 2, 3, 6						
	species.							
	Explain OTUs, character coding, resemblance measures, cluster							
5	analysis, dendrogram/ cladogram construction, bioinformatics, and	1, 2, 3, 6						
	sequencing methods.							

			SEMESTER	R – IV									
Cou	ırse Title			Microb	oiology-	-II							
Cou	ırse code	23MSBO223R	<b>Total credits: 2</b>	L	Т	P	S	R	O	/F	C		
			Total hours: 30T	2	0	0	0	0	(	)	2		
	-requisite	Nil	Co-requisite					Nil					
	gramme			r of Sci			•						
	emester	1 701 1	Winter/II semester of First year of the programme  1. The course deals with the microbial growth and microbial genetics.										
Course	e Objectives			_				_		.: . 4 1.	1		
			2. To make learner understand about genetic recombination, microbial biotechnology										
		_	and concept of genetic engineering.										
	CO1	-	3. To impart method of control of microorganisms.  Explain the microbial growth pattern, continuous culture and batch culture.										
	CO2		ial genetics, encomp										
	COZ	*		_	•								
		synthesis in mid	processes, and fun	idamen	itai as	pecis	01 D	INA, N	JNA,	and	protein		
	CO3		ic recombination, m	olegul	ar con	eties s	and ac	ne ev	reggi	on roo	nılotion		
	COS	in bacteria.	ic recombination, m	orccul	ai geile	ciics, è	mu ge	ne exp	n CSSI	on reg	guiation		
	CO4		pial biotechnology,	genet:	c and	ineerin	0.00	d anni	icatio	n of	genetic		
	CO4	engineering.	nai bioteemiology,	genen	c cligi	inceini	g, an	и аррг	icatio	)II ()I	genene		
	CO5	0	ods for controlling n	nicroor	roanien	ns rol	e of a	ntihioti	CS 91	nd cha	Henges		
	203		drug resistance in ba		Samon	10, 1010	on a	1110101	o, al	iiu Clia	incliges		
Unit-	Content	related to multi-	drug resistance in od	CH	Leari	ning O	utcom	e			KL		
No.	Content					ing o	uttom	•					
I	Microbial	Growth-Defini	tion of growth,	10	Knov	vledge	of r	nicrobi	al gı	rowth			
	Microbial	growth condit	ions and growth			growth							
	curves,	Mathematical	expression of										
	exponentia	l growth phase	, Measurement of								1,2		
	growth ar	nd growth yie	elds; Synchronous										
	growth;	Continuous cu	lture, Effect of										
	environme	ntal factors on g	rowth.										
II	Microbial	Genetics-		8	To le	earn tl	ne bas	sics of	micı	robial			
	Geneticma	terials,nuclearD	NA,chloroplastDN		genet	tics and	d gene	etic mat	terials	s.			
	1		nids,inheritanceoft								1,2		
		_	genetransfer,genesa								1,2		
		omes,DNArepli	cation,RNAand										
	protein syn												
III	Genetic	recombination		10				ne fore					
			nation in bacteria,			ı- ea			and	their			
			e genetic elements,		conse	ervatio	n strat	tegies.					
		_	Operon concept,								1,2		
	promoter,												
		-	g (RNA capping,										
13.7		il formation, RN	* *	1.0	Т	1	.4. 1	41 .	1				
IV			or human welfare,	10		unders			basic	_			
		and genomic	DNA library,		micro			echnolo	ogy	and			
	cloned	-	g, expression of etherapy, DNA		genet	tic eng	meern	ng.					
			etherapy, DNA plication of RNAi								1,2		
	technology		and siRNA) in										
	-	and medical sci	,										
	_												
	Geneue en	ignieering – 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,	7	Able to describe and explain	
	chemical and biological, Antibiotics, modeo		about the control of	1.2
	faction of antibiotics, multi drug resistance in		microorganisms and conrol action.	1,2
	bacteria.			

- 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			Ecolog	gy-I		,			
Cou	rse code	23MSBO222R	Total credits: 4	L		P	S	R	O/F	
	• •,	71.1	Total hours: 45T+3	30P 3	0	2	0	0	0	4
	requisite	Nil	Co-requisite	'ai an aa i	n Doton		Nil			
	gramme mester	W	Master of Sointer/II semester of F			•	ammo			
		1. To study the detail								
Course	Objectives	2. To study the detail	-				-	s conse	anena	es
		3. To study the different	•	-	_				quene	
	C <b>O</b> 1	ology, Evolutionar						and 1	related	
		branches.	eregj, Everenierur,	, 200	108), 2		20	0108)		
	CO2	Explain characteristi	cs of population	and c	commun	itv. re	egulat	on of	ecos	system
		processes, complex r					_			
		diversity.	1		8	<i>,</i> 1			1	
	C <b>O3</b>	Explain the ecologi	cal perturbations	(natura	ıl and	anthro	poger	ic), bi	o re	source
		sustainability, protect	-	-						
	CO4	Describe vegetation of			•				chan	iges in
		ecosystem properties.	•							
	CO5	Describe bioremediat	ion, biotransformati	ion, bio	odegrada	ition a	nd eco	ological	tech	niques
		for bio waste and e-w	aste management.							
Unit-	Content			СН	Learni	ng Out	come			KL
No.	D 1			1.0	**					
I	_	nent of ecology in Indi		10	Knowl	_		_	ıcal	
		nes, evolutionary eco			develo	pment	ın Inc	11a.		
		gical factors in the								
	Principle Introducti	spertaining to lon and elements of	imiting factors.							
			nceptual model,							1,2
	1	model, auxiliary varia	* '							
	_	Basic concepts to st								
	•	tal knowledge on								
		alysis and ordination.	F,,							
II		n concepts-character	istics, dynamics	8	To le	earn	the	basics	of	
	_	ntrol. Mechanisms	of population		popula		cone	cepts	in	
	regulation	i, habitat specific	demography,		ecolog	y.		•		
	population	n viability ana	lysis. Species			-				
	interaction	ns -types of interaction	ons, inter specific							
	competition	on, herbivory, carni	vory, symbiosis,							1,2
	allelopath	y, weed-cropinter fer	ence. Concept of							
	_		and dispersal,							
	interdemi	· · · · · · · · · · · · · · · · · · ·	age structured							
	1	ns. Ecological amplit	-							
	_	ation - ecads, eco type	-	1.0		-	-			
III	_	em stability-Concept	`	10				ie stabi	ılıty	
		); ecological perturbat	,		in ecos	system	•			
		genic) and their impa	-							1.2
	_	tems; ecology of	-							1,2
		, its importance & be								
	_	on and its consequen	•							
	communit	ty 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 –							
	rse Title			t Ecolog	1			1	T	
Cou	irse code	23MSBO223R	Total credits: 2	L	T	P	S	R	O/F	C
Date		NI:1	Total hours: 30T	2	0	0	0	0	0	2
	requisite	Nil	Co-requisite	Science	in Data		Nil			
	gramme mester		Master of Winter/II semester of			•	romm	•		
		1. To study the de	tail about Plant Popul							
Course	Objectives	1	Ecosystem stability, I				-		iseallen	ces
		· ·	ferent techniques of b		_				_	
	CO1	·	al restoration, ecosyst							graded
		ecosystem.	<u></u> 100001						01 00	5101010
	CO2		mental management	. susta	inable	deve	elopme	ent. e	environ	mental
		1 -	ply environmental im				_	,		
	CO3		ology, different forest					ositio	n. disci	uss the
		1 -	ues of North East Indi			,	,		,	
	CO4		ensing and Geograph		formati	ion Sv	stem	(GIS)	in ecol	logical
		studies.	2 2 1			J		` /		٥
	CO5	Describe phytoge	ographical regions of	India,	Vegeta	tion ty	pes of	India	, Biodi	versity
		significance of NI		,	C	J	-			J
Unit-		Content		СН		Learn	ing Ou	tcome		KL
No.										
I	_	_	storation, aims and	10		_		_	ots of	
	_	·	truction, major tools			gical	restor	ations	and	
			ation of biological		strate	egies.				
	1		ological succession,							1,2
			oration of degraded							
	1	_	assland and lake							
		contaminateds oils	•							
II	1 *		management, basic	8		vledge				
			lopment, advantages			igemer		nd i	mpact	
			ng, deterioration of		mana	igemer	ıt.			
	environme	•	vith reference to							
			ods of assessment of							1,2
			nort term studies/ Continuous short-							
	1	•	eneral guidelines for							
	_		ironmental impact							
	statement.		monmentar impact							
III			nanagement: Forest	10	To k	now al	out th	ne scot	oes of	
111	_		f India; changes in	10		onmer		_	.	
		• •	Cover; issues and				1110	magen	10110.	
		-	fting cultivation and							
	industriali		-							1,2
			and from hills and							,
			um and natural gas;							
		_	n of Ramsar sites of							
		India: Loktak lake								
IV			ncepts of remote	10	То	under	stand	the	basic	
	_		remote sensing in			ept a				1,2
	_		est survey, habitat			te sens	_			- ,-
	CHVIIOIIII	ciiai stadics. 101	ost survey, natitat							

	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	7	Able to describe and explain about the phytogeography	
	Western Himalayas, Eastern Himalayas, Assam, Gangetic plain, Indusplain, Malabar, Deccanete, Bio diversity significance of NE region.		and vegetation pattern of India.	1,2

- 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							
Cours	e Title		Plant Physiolog	y and	Bio	ochemi	istry-l	[			
Cours	se code	23MSBO222R	Total credits: 4		L		P	S	R	O/F	C
			Total hours: 45T+	30P	3	0	2	0	0	0	4
	quisite	Nil	Co-requisite					N	il		
	amme		Master of Science in Botany								
	ester		inter/II semester of								
	urse		ne mechanisms of men		tra	ansport,	, wate	r pot	ential,	, miner	al
Obje	ctives	1 -	ir regulation in plant o			1	L - 1:		م دا د. ا	41.	:_ :_
		_	lge of nitrogen fixation	n, nitro	oge	n metai	bolisn	n, and	a pnoi	osyntn	esis in
		plants.	hysiological processe	s involv	Već	d in flox	verine	rand	ther	amilatio	on of
		fruit developme		SHIVOI	vec	1 111 1101	wermş	ganu	i ine re	eguiano	011 01
		1	ne plant's physiologica	ıl resno	ากระ	es to a l	hiotic	stres	ses		
			role and mechanisms	•						rowth	
			ntrolling plant growth	_	_		-	.010	and g		
C	01		an understanding of					embr	ane tr	ansport	t, water
		_	eral uptake in plants,							_	
		ecological interact			Ū			,		C	
C	02	Students will deve	lop a deep understan	ling of	nit	trogen	fixatio	on, n	itroge	n meta	bolism,
		and photosynthesis in plants, and their ecological importance in nutrient cycling and									
		plant growth.									
C	03	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									
	0.7	environmental stress.  Students will understand the role and mechanisms of plant growth regulators and									
C	05	1					_	-		_	
		development in ag	, with practical ap	piicalio	ns	in co	ontroi	iing	piani	grow	ın ano
Unit-	Conten	1 0	ilculture.	СН	r	Learni	ing O	utoo	mo		KL
No.	Conten			CII	L	Learm	ing O	utco	ine		KL
I	Membr	ane transport a	nd water relations	: 10		Knowl	edge	of 1	mecha	nisms	
		-	oteins, water potentia				nembr			isport,	
			uptake and transpor			water					1,2,
	_		and iron transporter i	1		uptake	in pla	nts.			3
	plant, li	ght and microbes	induced signalling i	n							
		ell, regulation of wa									
II	_		spects of metabolism			Deep			ınding		
	_	_	fixation, products of			nitroge		katio	n, ni	_	
	_		transport, mechanism			metabo			_	and	1,2,
		-	ogical and molecula			photos	ynthe	sis in	plant	S	3
	_		NO metabolism i								
			lism in relation t	ט							
	respirati	OII.									

Ш	The flowering process: Photoperiodism and its significance, endogenous clock and its regulation, floral induction, role of vernalization. Fruit development and ripening: Stages of fruit development and their regulation, biochemical and related events during fruit ripening in climacteric and non-climacteric fruits. Physiology and biochemistry of fruit abscission, production of transgenic fruits.	10	To know about the physiological processes of flowering of plants.	1,2,
IV	Stress physiology and plant toxin: Plant responses to a biotic stresses, mechanisms of a biotic stress tolerance, water deficit and drought tolerance, salinity stress, metal toxicity and freezing.  Plant responses to metal ion stress, freezing and 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.	10	To acquire knowledge of plant responses to a biotic stresses, oxidative stress, and plant toxins.	1,2,
V	Plant growth regulators: A brief idea about discovers, role and possible mechanism of action of Triacontanol, Brassins, Salicylic acid. A brief idea about role of plant growth retardants-CCC, Maleic hydrazide, Trizoles and TIBA.	7	Able to understand the role and mechanisms of plant growth regulators and growth retardants.	1,2,
Practi cal	1. Determination of lipid from oil seeds.	3	Students will be able to estimate the lipid content in oilseeds.	1,2, 3,4
	2. Estimation of photosynthetic pigments by spectrophotometric and chromatographic techniques.	3	Practical skills in measuring and analyzing chlorophyll and carotenoid content in plant tissues.	1,2, 3,4
	3. To estimate the percentage of soluble protein of fresh moong, bean seedling by Lowry's Method and biuret reagent	3	Students will learn to estimate protein content in plant seedlings	1,2, 3,4
	4. Estimation of oxalic acid from leaf tissue.	3	Ability to measure oxalic acid levels in plants.	1,2, 3,4
	5. Estimation of starch, ascorbic acid, polyphenols, cellulose.	3	Students will learn to extract and estimate starch, Cellulose from plants	1,2, 3,4
	6. Extraction of plant phenols and estimation of total phenols.	3	Students will learn to extract and estimate phenolic compounds from plants	1,2, 3,4
	7. Study of seed germination under stress condition	3	practical experience in studying the effects of environmental stress on seed germination,	1,2, 3,4
	8. Study of effect of fungal infection on peroxidase activity.	3	Understand the role of peroxidase enzymes in plant defence mechanisms against fungal infections.	1,2, 3,4
	9. Estimation of total free amino acids from plant	3	To quantify free amino acids	1,2,

materials through spectrophotometer.		in plant tissues.	3,4
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.			

- 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 – I	V						
Course	Title	Plant Physiology and Biochemistry-II								
Course code		23MSBO223R	Total credits: 2	L	T P		R	O/F	C	
			Total hours: 30T	2	0 0		0	0	2	
Pre-req		Nil	Co-requisite			Nil				
Program		Master of Science in Botany								
Semes		Winter/II semester of First year of the programme								
Cour		1. To understand the key biochemical pathways involved in plant respiration.								
Object	ives	2. To explore the mechanisms of photochemistry and photosynthesis.  3. To understand early hydrate and erganic acid metabolism.								
		3. To understand carbohydrate and organic acid metabolism.  4. To study enzyma kinetics and nitrogen metabolism.								
		<ul><li>4. To study enzyme kinetics and nitrogen metabolism.</li><li>5. To explore plant signal transduction pathways to understand various plant</li></ul>								
		signalling mechanisms.								
CO	1	Students will gain an in-depth understanding of the biochemical processes involved in								
	-	plant respiration.								
CO	2	* *	quire a comprehensiv	e und	lerstandin	g of th	e med	chanis	ms of	
		Students will acquire a comprehensive understanding of the mechanisms of photosynthesis								
CO	3	μ ,	Students will learn the regulation of carbohydrate metabolism and sucrose biosynthesis,							
		cellulose synthesis and metabolic roles of organic acids.								
CO	4	Students will develop an understanding of enzyme kinetics, including the calculation of								
		Km values.								
CO	5	_	n knowledge of plant	_		tion mec	hanism	ns, inc	cluding	
			signaling, phospholipid							
Unit-		Conte	ent	СН	Lea	rning Ou	ıtcome		KL	
No.	D .			1.0	G. 1	*11 1		1.1		
I	_	•	netabolism: Overview	10		will und				
	_	•	ron transport and ATP	ulation, plant respiration.						
	1 -		ants and its regulation,						1,2,3	
		cycle, inhibitor of respiration, glyoxylate								
	l	synthesis of membr								
II		· · ·	notosynthesis:, Photo-	8	Students	will	learn	the		
	l		anism of electron and		mechanisms		of			
			ion of PCR cycle and		photosyi	nthesis,	inclu	ding	1 2 2	
	C4 pa	thway, RUBISCO	and PEP Case, C3-C4		the pl	hoto-oxid	lation	of	1,2,3	
_		nediates, ecologic	al significance and		water, e	electron	and pr	oton		
	modif	ication of CAM.			transpor					
Ш	"		10	Students	will und	erstand	d the			
	_		sucrose biosynthesis,		-	on of s		and		
	1 -	~	n of cellulose, a brief		sucrose	biosynthe	esis		1,2,3	
	l		thesis and enzymes						-,-,-	
	l		lation, metabolism and							
11.7		· · · · · · · · · · · · · · · · · · ·	bic acid and malic acid	10	Cto dant		1	ani		
IV	_		lue, enzyme inhibition,	10	Students			gain		
	factors responsible for enzyme interaction, abzyme and ribozyme. Organization, function kinetics, including			yme the						
		gulation of nif and	~		determin		of	Km		
		criptional and post t	-		values.		01	12111	1,2,3	
		tion of nitrate assim	•		. 31405.					
	_	cular aspects of seed	-							
	dorma	-								
	l	•		1	1					

V	<b>Signal transduction</b> : 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.		1,2,3
	its role in biosynthesis of secondary metabolites,				
	biosynthesis of terpens, phenols and nitrogenous				
	compounds.				

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- 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			