Assam down town University

Curriculum and Syllabus

B.Sc. (Hons.) Agriculture

OUTCOME BASED EDUCATION FRAMEWORK

CHOICE BASED CREDIT SYSTEM

Version: 1.0

FACULTY OF AGRICULTURAL SCIENCES AND TECHNOLOGY

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 Agricultural Sciences and Technology held on dated 23/09/2023 and approved by the 47th Academic Council (AC) meeting held on 27/12/2023.

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. (Hons.) Agriculture programme is a 4 year undergraduate degree that focuses on the science and practices of agriculture. It is designed to provide students with a comprehensive understanding of various aspects of agriculture, including crop cultivation, animal husbandry, soil science, agribusiness, and agricultural technology. The programme combines theoretical knowledge with practical skills to equip students with the expertise needed for sustainable and efficient agricultural practices.

I. Specific Features of the Curriculum:

The curriculum provides professional agricultural solutions in understanding societal and environmental impacts by advocating sustainable organic agricultural practices. The curriculum also enables skill development in various agripreneurial activities with efficient verbal and written communication skill for knowledge transmission with stakeholders.

II. Eligibility Criteria:

Minimum 50% in 10+2 or equivalent examination from a recognized board or educational institution. 5% relaxation for SC/ST, EWS, and specially-abled candidates. Qualifying examination should include specific subjects Biology, Chemistry and Physics in Science Stream.

III. Programme Educational Objectives (PEOs):

PEO-1: Lead and contribute to innovative agricultural practices by applying critical thinking and problem-solving skills to address challenges in agriculture and allied sectors.

PEO-2: Understand the diversity in modern agricultural practices/initiatives and impact of globalization & to help acquire global perspective in agriculture.

PEO-3: Enhance knowledge and skills in agriculture, adapting to evolving industry trends and technologies, and pursuing diverse career opportunities in government, public, and private sector.

IV. Programme Specific Outcomes (PSOs):

PSO1: Sustainable Agriculture Advocacy: Understanding the societal and environmental impacts of professional agricultural solutions and advocating sustainable organic agricultural practices.

PSO2: Entrepreneurial proficiency: Developing skills for entrepreneurial activities in various agricultural production systems.

PSO3: Proficiency in Effective Communication Skills: Acquiring advanced skills for effective verbal and written communication for knowledge transmission with stakeholders.

V. Programme Outcomes (POs):

PO1: Agricultural knowledge: Developing fundamental and applied knowledge in agriculture to address issues in crop production, improvement, and protection, while also gaining expertise in farm management.

PO2: **Technical skills:** Developing specific skills to manage production problems in various spheres of agriculture through systematic experiential learning.

PO3: Effective communication: Developing ability to convey information and ideas clearly and persuasively with all stakeholders to facilitate understanding and collaboration in agriculture and allied sectors.

PO4: **Research oriented mindset:** Instilling research temperament by developing capacity for critical observation and out of the box thinking.

PO5: Entrepreneurship and Employability: Building proficiency to foster a mindset and skillset that empower graduates to excel, innovate, and succeed in the professional world and to venture into entrepreneurship.

PO6: Environment and Sustainability: Understanding eco-friendly farming practices, resource conservation & implementing sustainable solutions.

PO7: Conducting experiments and Data analysis: Developing ability to design and conduct experiment, analyse data and interpret results.

PO8: Modern tool usage: Developing skills in advanced technologies, precision farming tools, and data analytics to boost productivity and efficiency.

PO9: Policy making: Understanding and contributing to agricultural policies that affect the industry, ensuring sustainable and equitable development.

PO10. Leadership and Teamwork: Developing sense of responsibility to collaborate with peers, farmers and agricultural professionals, and to assume leadership roles for effective farm management.

PO11. Community engagement and Extension: Actively participating in community development, and extending agricultural expertise to benefit society.

PO12. Lifelong Learning: Develop a mindset for learning from all stakeholders including the farmers, the subject matter specialists and the experts.

VI. Total Credits to be Earned: 190

VII. Career Prospects:

Upon completion of the B.Sc. (Hons.) Agriculture programme, graduates are prepared for diverse career paths in the agricultural sector, including farm management, agricultural research, agribusiness, extension services, and government agricultural agencies and civil service examinations. The programme aims to produce professionals who can contribute to the development of innovative and sustainable agricultural practices to address the challenges of food security and environmental sustainability.

EVALUATION METHODS

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

A. INTERNAL ASSESSMENT:

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

S.N.	Components/ Examinations	Marks Allotted
1.	Mid Term	30
2.	End Term Examination	50
3.	Practical Examination	15
4.	Assignment	5

are compulsory

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 programme coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the programme 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, 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 programme follow a unique pattern and the total marks is 60.

Table 1: Question paper pattern for End semester examination

S.N.	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 50 marks set by an external paper setter shall ordinarily be of two hours duration.

V. Practical Examinations, Viva-Voce etc.:

i) Practical examination shall be conducted in presence of the 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 Programme 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 × 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
B	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 2.

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad (1.1)$$

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 i^{th} 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 2, 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 i^{th} completed Course and Ci is the Credit (weight) of that Course.

$$\text{CGPA} = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \qquad (1.2)$$

(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 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 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, 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 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

S.N.	Category		Total number of Credits
1	University Core (UC)	Skill Enhancement Course (SEC)	0
		Ability Enhancement Course (AEC)	6
		Field Training	0
		Discipline Specific Elective (DSE)	0
		Value Added Course (VAC)	0
2	University Elective (UE)	Multidisciplinary Course (MDC)	7
		Value Added Course (VAC)	0
3	Programme Core (PC)	Discipline Specific Core (DSC)	119
		Field Training	14
		Research /Industry Internship	4
		Summer Internship	20
4	Programme Elective (PE)	Discipline Specific Elective (DSE)	9
		Value Added Course (VAC)	2
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	6
		Ability Enhancement Course (AEC)	3
Total			**190**

Breakdown by categories of courses

S.N.	Category	Credits	%
1	Agricultural Science	164	86%
2	Science	13	7%
3	Engineering	4	2%
4	Humanities & Social Sciences	9	5%
Total		**190**	**100%**

SEMESTER WISE COURSE DISTRIBUTION

	S. N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester I	1	23BSAG1101R	Fundamentals of Agronomy	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	2	23BSAG1102R	Agricultural Water Management	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	3	23BSAG1103R	Introduction to Forestry & Agroforestry	DSC (Minor)	1	0	2	0	0	0	**2**	30	50	20	100
	4	23BSAG1104R	Fundamentals of Horticulture	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	5	23BSAG1105R	Fundamentals of Soil Science	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	6	23BSAG1106R	Fundamentals of plant Biochemistry & Biotechnology	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	7	23BSAG1107R	Rural Sociology and Educational Psychology	DSC (Major)	2	0	0	0	0	0	**2**	50	50	00	100
	8	23BSAG1108R	Comprehension & Communication Skills in English	SEC	1	0	2	0	0	0	**2**	30	50	20	100
	9	23BSAG1109R	Agricultural Heritage*	DSC (Minor)	1	0	0	0	0	0	**1**	50	50	00	100
	10	23BSAG1110R	Introductory Biology*	MDC	1	0	2	0	0	0	**2**	30	50	20	100
			Elementary Mathematics*		2	0	0	0	0	0		50	50	00	
	11	23BSAG1111R	Human Values & Ethics**	DSC (Minor)	1	0	0	0	0	0	**1**	50	50	00	100
	12	23BSAG1112R	Physical Education and Yoga** **(Extra Co-curricular Activity)**	AEC (Programme)	0	0	2	0	0	0	**1**	0	0	100	100
	13	23BSAG1113R	NSS**	AEC (Programme)	0	0	2	0	0	1	**1**	0	0	100	100
	14	23BSCE1101R	MOOCS (Environmental Science)	VAC	2	0	0	0	0	0	**2**	0	0	0	100
	Total										**26**				**1400**

***Remedial Course**
****Non-gradial courses**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester II	1	23BSAG1201R	Fundamentals of Genetics	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	2	23BSAG1202R	Fundamentals of Microbiology	MDC	1	0	2	0	0	0	**2**	30	50	20	100
	3	23BSAG1203R	Manures, fertilizers and soil fertility management	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	4	23BSAG1204R	Fundamentals of Crop Physiology	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	5	23BSAG1205R	Fundamentals of Agricultural Economics	DSC (Major)	2	0	0	0	0	0	**2**	50	50	00	100
	6	23BSAG1206R	Fundamentals of Plant Pathology	DSC (Major)	3	0	2	0	0	0	**4**	30	50	20	100
	7	23BSAG1207R	Production Technology for fruits and plantation crops	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	8	23BSAG1208R	Fundamentals of Agricultural Extension Education	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	9	23BSAG1209R	Crop Production Technology – II (*Rabi* Crops)	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	10	23BSAG1210R	National Service Scheme*	AEC (Programme)	0	0	2	0	0	0	**1**	00	00	100	100
	11	23UBPD122R	Implicit English	AEC (University)	0	0	4	0	0	0	**2**	00	00	100	100
	Total										**26**				**1100**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester III	1	23BSAG2101R	Crop production Technology – I (Kharif Crops)	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	2	23BSAG2102R	Fundamentals of Plant Breeding	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	3	23BSAG2103R	Agricultural Finance and Cooperation	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	4	23BSAG2104R	Fundamentals of Entomology	DSC (Major)	3	0	2	0	0	0	**4**	30	50	20	100
	5	23BSAG2105R	Agri-Informatics	DSC (Minor)	1	0	2	0	0	0	**2**	50	50	00	100
	6	23BSAG2106R	Farm Machinery and Power	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	7	23BSAG2107R	Production Technology for Vegetables and Spices	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	8	23BSAG2108R	Environmental Studies and Disaster Management	MDC	2	0	2	0	0	0	**3**	30	50	20	100
	9	23BSAG2109R	Communication Skills and Personality Development	SEC	1	0	2	0	0	0	**2**	30	50	20	100
	10	23UBPD212R	English Language for Excellence	AEC (University)	0	0	4	0	0	0	**2**	00	00	100	100
	Total										**25**				**1000**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester IV	1	23BSAG2201R	Statistical Methods	DSC (Minor)	1	0	2	0	0	0	**2**	30	50	20	100
	2	23BSAG2202R	Production Technology for Ornamental Crops, MAP and Landscaping	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	3	23BSAG2203R	Renewable Energy and Green Technology	DSC (Minor)	1	0	2	0	0	0	**2**	30	50	20	100
	4	23BSAG2204R	Problematic Soil and their Management	DSC (Major)	2	0	0	0	0	0	**2**	50	50	00	100
	5	23BSAG2205R	Introductory Agro-meteorology & Climate Change	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	6	23BSAG2206R	Principles of Seed Technology	DSC (Major)	1	0	4	0	0	0	**3**	30	50	20	100
	7	23BSAG2207R	Farming System and Sustainable Agriculture	DSC (Major)	1	0	0	0	0	0	**1**	50	50	00	100
	8	23BSAG2208R	Agricultural Marketing Trade and Prices	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	9	23BSAG2209R	Livestock and Poultry Management	DSC (Minor)	3	0	2	0	0	0	**4**	30	50	20	100
	10	23BSAG2210R	Elective Course (Student has to take any one of the following courses) a. Agro Chemicals b. Biopesticides & Biofertilizers c. Micro Propagation Technologies Protected Cultivation	DSE (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	11	23UBPD2202R	English for employability	AEC (University)	0	0	4	0	0	0	**2**	00	00	100	100
	Total										**26**				**1100**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester V	1	23BSAG3101R	Principles of Integrated Pest and Disease management	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	2	23BSAG3102R	Soil and Water Conservation Engineering	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	3	23BSAG3103R	Pests of Crops and Stored Grains and their Management	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	4	23BSAG3104R	Diseases of Field and Horticulture Crops and their Management - I	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	5	23BSAG3105R	Crop Improvement- I (Kharif Crops)	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	6	23BSAG3106R	Entrepreneurship Development and Business Communication	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	7	23BSAG3107R	Geo informatics and Nanotechnology and Precision Farming	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	8	23BSAG3108R	Practical Crop Production – (Kharif Crops)	DSC (Major)	0	0	4	0	0	0	**2**	00	00	100	100
	9	23BSAG3109R	Intellectual Property Rights	DSC (Minor)	1	0	0	0	0	0	**1**	50	50	00	100
	10	23BSAG3110R	Elective Course (Student has to take any one of the following courses) a. Landscaping b. Weed Management c. Commercial Plant Breeding d. Agri Business Management	DSE (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	Total										**23**				**1000**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VI	1	23BSAG3201R	Rain fed Agriculture & Watershed Management	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	2	23BSAG3202R	Protected Cultivation and Secondary Agriculture	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	3	23BSAG3203R	Diseases of Field and Horticultural Crops and their Management-II	DSC (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	4	23BSAG3204R	Post-harvest Management and Value Addition of Fruits and Vegetables	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	5	23BSAG3205R	Management of Beneficial Insects	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	6	23BSAG3206R	Crop Improvement-II (*Rabi* crops)	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	7	23BSAG3207R	Practical Crop Production –II (*Rabi* crops)	DSC (Major)	0	0	4	0	0	0	**2**	00	00	100	100
	8	23BSAG3208R	Principles of Organic Farming	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	9	23BSAG3209R	Farm Management, Production & Resource Economics	DSC (Major)	1	0	2	0	0	0	**2**	30	50	20	100
	10	23BSAG3210R	Principles of Food Science and Nutrition	DSC (Minor)	2	0	0	0	0	0	**2**	50	50	00	100
	11	23BSAG3211R	Elective Course (Student has to take any one of the following courses) a. System simulation and Agro-advisory b. Hi-Tech Horticulture c. Agricultural Journalism d. Food Safety & Standards	DSE (Major)	2	0	2	0	0	0	**3**	30	50	20	100
	Total										**24**				**1100**

	S.N.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VII	1	23BSAG4101R	Rural Agricultural Work Experience	Field Training	0	0	28	0	0	0	**14**	00	00	100	100
	2	23BSAG4102R	Plant Clinic	SEC	0	0	4	0	0	0	**2**	00	00	100	100
	3	23BSAG4103R	Agro – Industrial Attachment	Industry Internship	0	0	8	0	0	0	**4**	00	00	100	100
	Total										**20**				**300**
	S.N.	**Course Code**	**Course Title**	**Course Category**	**Engagement**							**Maximum Marks for**			
					L	**T**	**P**	**S**	**R**	**O**	**C**	**IA***	**SEE***	**PE***	**Total**
Semester VIII	**Out of eight (8) courses students have to take any two of the following:**														
	1	23BSAG4201R	Production Technology for Bio-agents and Bio-fertilizer	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	2	23BSAG4202R	Seed Production and Technology	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	3	23BSAG4203R	Mushroom Cultivation Technology	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	4	23BSAG4204R	Soil, Plant, Water and Seed Testing	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	5	23BSAG4205R	Commercial Beekeeping	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	6	23BSAG4206R	Poultry Production Technology	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	7	23BSAG4207R	Commercial Horticulture	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	8	23BSAG4208R	Floriculture and Landscaping	Summer Internship	0	0	20	0	0	0	**10**	00	00	100	100
	Total										**20**				**200**

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

SEMESTER – I									
Course Title	**Fundamentals of Agronomy**								
Course Code	**23BSAG1101R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To learn about different crops, their growth requirement and how to optimize their yield. 2. To understand soil properties, fertility and management for sustainable crop production 3. To acquire skills in planting, cultivation, pest and disease control and harvesting techniques								
CO1	Express Knowledge gain on principle of agronomy.								
CO2	Recognize the various nutrient and their effect on plant health.								
CO3	Apply scientific method and tools in field preparation and for designing cropping.								
CO4	Plan for sustainable agriculture production.								
CO5	Manage weed in the field.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Agriculture – definition and importance of agriculture, Agronomy – meaning and scope of Agronomy, Types of seed, dormancy of seeds, Viability of seeds, seed treatment, Sowing – methods, depth, plant density, Nursery bed and transplanting, Crop density and geometry, Optimum plant population	**4**	Study on fundamental concept of agriculture and agronomy, seed and its types, sowing of seeds and transplanting, optimum plant population	1,2
II	Tillage – definition and types of tillage including minimum and no tillage, Tilth-definition and characteristics of good tilth	**2**	Study on basic concept of land preparation	2,3
III	Crop nutrition – essential nutrients – classification, Nutrient mobility in plants, Factors affecting nutrient availability, Function and deficiency symptoms of primary nutrients, Manures- types, nutrient content, Green manure, Compost; Fertilizer, Integrated nutrient management, Nutrient use efficiency	**3**	Study on nutrients required for the proper growth and development of crops	2,3
IV	Growth and development of crops- factors affecting, Plant Ideotypes, Crop rotation and its principle, Crop management technologies in problematic, Harvesting and threshing of crops	**2**	Study on growth and development of cropping pattern and sustainable management practices adopted in crop production	1,3
V	Weed reproduction and seed dissemination, Crop weed competition- concept and allelopathy, Concept of weed prevention, eradication and weed Control, Physical, cultural, chemical and biological method of weed control, Integrated weed management – an introduction, Introduction to herbicides, advantages and limitation of Herbicides	**4**	Study on different types of weeds grown in crop field, their related terms and management practices	2,3

		usage, Classification of herbicides, Herbicidal selectivity and resistance			
Practical	1	Identification of field crops	**30**	Study on various agronomic crops, their scientific name and family	2,3
	2	Study of agro climatic zones of India		Study on details on different agro-climatic zones of India	1,2
	3	Study of agro climatic zones of Assam		Study on details on different agro-climatic zones of Assam	1,2
	4.	Use of tillage implements –plough, harrow, leveler, seed drill etc.		Study on use of different tillage implements	2,3
	5.	Numerical on estimation of plant populations		Study on calculation of Optimum plant population	2,3
	6.	Study of yield contributing characters and yield		Study on calculation of estimated yield of a crop	2,3
	7.	Seed germination test		Study on various germination test	2,3
	8.	Seed viability test		Study on seed viability test	2,3
	9.	Methods of herbicide and fertilizer application		Study on different methods for applying fertilizer and herbicides	2,3

TEXT BOOKS:

T1: SR Reddy, Principles of Agronomy, Kalyani Publication, New Delhi

REFERENCE BOOKS:

R1: T.Yellamanda Reddy, G.H. Sankara Reddy, Principles of Agronomy, Kalyani Publication, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Express Knowledge gain on principle of agronomy.	1,2,3,4,5,6,7,8,9,11,12
2	Recognize the various nutrient and their effect on plant health.	1,2,4,6,7,8,9,12
3	Apply scientific method and tools in field preparation and for designing cropping.	1,2,4,5,6,7,8,9,10
4	Plan for sustainable agriculture production.	1,2,4,6,7,8,9,12
5	Manage weed in the field.	1,2,4,5,6,7,8,9,10,12

SEMESTER – I									
Course Title	**Agricultural Water Management**								
Course Code	**23BSAG1102R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To learn techniques for efficient utilization of water in agriculture. 2. To understand methods of conserving water resources specially in drought condition. 3. To monitor and maintain the quality of irrigation water, preventing contamination of crops and soil.								
CO1	Understanding the importance and function of water in plant growth.								
CO2	Gain proficiency in the knowledge of soil moisture stress.								
CO3	Comprehend and execute the principle of available and unavailable soil moisture.								
CO4	Explain about water use efficiency and irrigation methods.								
CO5	Understanding the quality of irrigation water along water management in field crops.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Importance of Water, Hydrological Cycle and function of water in plant growth, Water resources – Water resources in world, India and Assam. Major irrigation project in India and Assam. Area of different crops under irrigation. Reason for poor utilization of irrigation resources in India. Effective measures for optimum utilization of water resources	**2**	Study on brief introduction to water, its properties and function of water in plant growth and development along with different water resources available in World, India and Assam	1,2
II	Effect of moisture stress on crop growth – Effect of moisture deficit, effect of excess water, Drought avoidance, Drought tolerance and escape mechanism, Moisture sensitive stages of some crops. Crop adaption mechanism to moisture stress	**2**	Study on water stress occurs in the plants due to various environmental condition and its management	2,3
III	Available and unavailable soil moisture – kinds of soil water, soil moisture constant, Measurement of soil moisture – Direct methods and indirect methods, Water requirement of crops – consumptive use of water, Irrigation requirement, Net irrigation requirement, Gross irrigation requirement, Factors affecting water requirement, Determination of water requirement, some terminology related to water/irrigation requirement, WRSI (Water Requirement Satisfaction Index, Duty and delta of crops	**4**	Learn about the moisture availability in the soil, types of soil moisture constant and methods to measure available soil moisture. Study of irrigation requirement, Factor affecting water requirement	2,3

IV	Methods of irrigation – surface and subsurface, advantages and disadvantages of different irrigation method. Micro irrigation-Drip irrigation and Sprinkler irrigation and its advantages and disadvantages, Irrigation scheduling – importance, criteria of irrigation scheduling, theoretical approaches of irrigation scheduling, Rooting characteristics and moisture extraction pattern, Fertigation – Characteristics of fertilizer for fertigation, sources of nutrients, time of application, advantages and disadvantage	**4**	Study on various methods of irrigation use now a days , their merits and demerits, scheduling of irrigation, moisture extraction pattern of roots and fertigation	2,3
V	Water use efficiency, Factors affecting WUE, Methods to improve WUE, Types of problem soil, problem of poor quality water. Water management of problem soil, Quality of irrigation water and suitability of irrigation water, Water management of different field crops	**3**	Study on efficient use of water , water management in problem soil, quality of irrigation and water management in field crops	3,4
Practical	1. Determination of soil bulk density 2. Estimation of soil moisture content by gravimetric method 3. Estimation of soil moisture content by Tensiometer 4. Calculation of irrigation requirement 5. Study about different soil moisture constant 6. Determination of field capacity 7. Study about different methods of irrigation 8. Study about the layout of drip irrigation 9. Study about irrigation scheduling 10. Irrigation scheduling in green house and poly house 11. Study about drainage and its importance	**30**	Acquire practical skills in determining soil properties (bulk density, moisture content, and field capacity) and understanding irrigation methods, scheduling, and requirements for efficient water management in agriculture, including greenhouse and polyhouses setups. They will also understand the importance of drainage, soil conservation, and agronomic measures to maintain soil health and sustainability.	2,3,4

TEXT BOOKS:

T1: SR Reddy, Principles of Agronomy, Kalyani Publication, New Delhi

REFERENCE BOOKS:

R1: T. Yellamanda Reddy, G.H. Sankara Reddy, Principles of Agronomy, Kalyani Publication, New Delhi
R2: SR Reddy, GK Reddy, Irrigation Agronomy, Kalyani Publication, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understanding the importance and function of water in plant growth.	1,2,3,4,5,6,7,8,9,10,11,12
2	Gain proficiency in the knowledge of soil moisture stress.	1,2,3,4,5,6,7,8,9,11,12
3	Comprehend and execute the principle of available and unavailable soil moisture.	1,2,3,4,5,6,7,8,9,10,11,12
4	Explain about water use efficiency and irrigation methods.	1,2,4,5,6,7,8,9,10,11,12
5	Understanding the quality of irrigation water along water management in field crops.	1,2,3,4,5,6,7,8,9,10,11,12

SEMESTER – I									
Course Title	**Introduction to Forestry & Agroforestry**								
Course Code	**23BSAG1103R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**CO-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To provide a solid foundation in Forestry, encompassing theoretical understanding, practical skills 2. To create an awareness of the basic forestry and environmental contexts in which forestry practices operate. 3. To focus on basic knowledge of forestry such as, silviculture, mensuration, agroforestry and its related topics in a more targeted and comprehensive understanding of the subject.								
CO1	Understand basic forestry terminology, objectives of silviculture, and forest classification principles								
CO2	Gain comprehensive knowledge of Indian forest policies, forest regeneration techniques, and essential preliminary considerations in forestry management								
CO3	Familiarize with crown classification and various tending operations like weeding, cleaning, and thinning in forest management								
CO4	Acquire proficiency in forest mensuration, including objectives and methods for measuring tree diameter, height, and volume								
CO5	Learn to identify tree species suitable for different purposes such as agroforestry, wasteland reclamation, windbreaks, shelterbelts, and medicinal and aromatic plant cultivation								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to basic terms of forestry and Silviculture, Forest Classification and salient features of Indian Forest policies.	**3**	Understand fundamental forestry and silviculture concepts, forest classification systems, and key aspects of Indian forest policies to build a foundation for sustainable forest management practices.	1,2
II	Methods of Forest Regeneration - Natural regeneration and Artificial regeneration, choice between natural and artificial regeneration with essential preliminary considerations.	**3**	Develop an understanding of natural and artificial forest regeneration methods, evaluate the factors influencing the choice between them, and learn essential considerations for effective forest regeneration.	3,5
III	Crown classification and Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.	**3**	Learn to classify tree crowns, understand various tending operations such as weeding, cleaning, and thinning, and apply thinning techniques (mechanical, ordinary, crown, and advance) to enhance forest health and productivity.	2,3
IV	Forest mensuration – objectives, Instrumental and Non-Instrumental methods, diameter measurement, instruments used in diameter measurement.	**3**	Understand the objectives of forest mensuration, explore instrumental and non-instrumental methods, and gain proficiency in measuring tree diameters using various instruments.	2,3

V	Importance of Agroforestry, study on different agroforestry systems and cultivation practices of fast-growing tree species prevalent in the country.	**3**	Understand the significance of agroforestry, explore various agroforestry systems, and learn cultivation practices for fast-growing tree species commonly used across the country.	1,2,3
Practical	1. Identification of Tree species 2. Identification of Trees species for timber, fuel-wood, fodder and road-side plantations. 3. Identification of Tree Species for Wasteland, Fieldbunds. windbreak and shelterbelt 4. Visit to Miya-Waki forest plot at AdtU campus. 5. Identification of Multipurpose, Minor Forest and Nitrogen Fixing Tree species suitable for Agroforestry. 6. Diameter measurements using Calipers and Tape. 7. Diameter measurements of forked, buttressed, fluted and leaning trees. 8. Height measurement of standing trees by shadow method, single pole method and hypsometer. 9. Volume measurement of Logs using various formulae. 10. Nursery lay out, seed-sowing. 11. Vegetative propagation techniques – natural and artificial. 12. Forest plantations and their management. 13. Visits of nearby forest-based industries.	**30**	Gain knowledge and skills in identifying tree species for various uses, measuring tree dimensions (diameter, height, and volume), and understanding forestry practices, including nursery management, propagation techniques, plantation management, and forest-based industries.	1,3,5

TEXT BOOKS:

T1 SR Reddy and C. Nagamani (2022). Introduction of Forestry.
T2 L.S. Khanna (2008). Principles & Practice of Silviculture.

REFERENCE BOOKS:

R1. A. N. Chaturvedi and L. S. Khanna (2011). Forest Mensuration**.**

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand basic forestry terminology, objectives of silviculture, and forest classification principles	1,2,4,5,6,9,10,11,12
2	Gain comprehensive knowledge of Indian forest policies, forest regeneration techniques, and essential preliminary considerations in forestry management	1,2,3,4,5,6,7,8,9,10,11, 12
3	Familiarize with crown classification and various tending operations like weeding, cleaning, and thinning in forest management	1,2,4,5,6,7,8,10,12
4	Acquire proficiency in forest mensuration, including objectives and methods for measuring tree diameter, height, and volume	1,2,3,4,5,6,7,8,10,12
5	Learn to identify tree species suitable for different purposes such as agroforestry, wasteland reclamation, windbreaks, shelterbelts, and medicinal and aromatic plant cultivation	1,2,4,5,6,7,8,10,11,12

SEMESTER – I									
Course Title	**Fundamentals of Horticulture**								
Course Code	**23BSAG1104R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To provide a solid foundation in horticulture, encompassing theoretical understanding, practical skills 2. To create an awareness of the broader agricultural and environmental contexts in which horticulture operates. 3. To focus on plant growth and development, plant propagation, crop nutrition and their requirements, ensuring a targeted and comprehensive understanding of the basics of horticulture.								
CO1	Understanding Horticulture, its origin, its branches, its importance, crop classification & soil and climatic requirements								
CO2	Acquiring knowledge of basic principles and practices of plant propagation methods and ability to propagate horticultural crops								
CO3	Acquiring knowledge of various horticultural practices and designing orchards and landscapes								
CO4	Understanding the crop life cycle, their fertilization and pollination processes, factors responsible for unfruitfulness in crops								
CO5	Knowledge of importance and usage of bio-regulators in horticulture crops & identification of various horticultural crops including medicinal and aromatic crops								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Horticulture- Its Definition, branches, importance and scope, Horticultural and Botanical Classification of crops, Climate and soil for horticultural crops	**3**	Gain foundational knowledge of horticulture, including its definition, branches, importance, and scope, along with understanding the classification of crops and the role of climate and soil in horticultural crop cultivation.	1,2
II	Plant propagation methods, Plant propagating structures, Seed dormancy and seed germination	**3**	Learn various plant propagation methods, understand the use of propagation structures, and gain insights into seed dormancy mechanisms and factors influencing seed germination.	1,2
III	Principles of orchard establishment, Principles and methods of training and pruning, Irrigation and its methods, Fertilizer application in horticultural crops	**3**	Understand the principles of orchard establishment, learn training and pruning methods, explore various irrigation techniques, and acquire knowledge of fertilizer application practices in horticultural crops for optimal growth and yield.	2,3
IV	Juvenility and flower bud differentiation, Unfruitfulness in horticultural crops, Pollination, pollinizers and pollinators, Fertilization and parthenocarpy	**4**	Gain an understanding of juvenility, flower bud differentiation, and factors causing unfruitfulness in horticultural crops, along with knowledge of pollination, pollinizers, pollinators,	1,2

			fertilization processes, and parthenocarpy.	
V	Medicinal and aromatic plants, Importance of bio-regulators in horticulture	**2**	Understand the significance and cultivation of medicinal and aromatic plants, and learn about the role and applications of bio-regulators in enhancing horticultural practices.	1,2
Practical	1. Identification of Fruit crops 2. Identification of Vegetable and Tuber crops 3. Identification of Flowers crops 4. Identification of different garden tools and implements 5. Layout and planting of Orchard 6. Nursery bed preparation for raising rootstocks and seedlings 7. Plant Propagating Structures and specialized plant parts for propagation 8. Transplanting and care of vegetable seedlings 9. Preparation of Potting mixture, potting and repotting 10. Harvesting and post-harvest handling of horticultural crops 11. Visit to Commercial Nurseries and Orchards	**30**	Develop skills in identifying fruit, vegetable, tuber, and flower crops, as well as garden tools and implements. Gain practical knowledge in orchard layout and planting, nursery bed preparation, propagation techniques, transplanting, potting, and repotting. Learn methods for harvesting, post-harvest handling of horticultural crops, and gain exposure through visits to commercial nurseries and orchards.	2, 3, 4, 5, 6

TEXT BOOKS:

T1: Jitendra Singh. (2017) Fundamentals of Horticulture, Kalyani Publishers, Ludhiana.

T2: Jitendra Singh. (2002) Basic Horticulture, Kalyani Publishers, Ludhiana.

REFERENCE BOOKS:

R1: P. Muthukumar., R. Selvakumar. (1957). Glaustas Horticulture, New Vishal Publication.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understanding Horticulture, its origin, its branches, its importance, crop classification & soil and climatic requirements	1,2,4,5,6
2	Acquiring knowledge of basic principles and practices of plant propagation methods and ability to propagate horticultural crops	1,2,4,5,6,11
3	Acquiring knowledge of various horticultural practices and designing orchards and landscapes	1,2,4,5,6,11
4	Understanding the crop life cycle, their fertilization and pollination processes, factors responsible for unfruitfulness in crops	1,2,4,5,6,7,11
5	Knowledge of importance and usage of bio-regulators in horticulture crops & identification of various horticultural crops including medicinal and aromatic crops	1,2,4,5,6,11

SEMESTER – I									
Course Title	**Fundamentals of Soil Science**								
Course Code	**23BSAG1105R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. Understanding Soil as a Natural Body 2. Analysing Soil Physical and Chemical Properties 3. Exploring Soil Classification and Taxonomy								
CO1	Explain the processes of soil genesis, including the role of rocks, minerals, and weathering in soil formation, and identify components of soil profiles								
CO2	Analyse soil physical properties (texture, structure, porosity, etc.) and classify soils using elementary taxonomy principles, including an overview of Indian soils								
CO3	Understand soil water retention, movement, availability and the impact of soil air, temperature, and pH on plant growth and nutrient availability								
CO4	Understand the concept of soil colloids, organic matter, and ion exchange processes								
CO5	Explain strategies to prevent and mitigate soil pollution caused by pesticides and inorganic contaminants, incorporating sustainable soil management practices								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil.	**3**	Understand soil as a natural body, its pedological and edaphological concepts, genesis through soil-forming processes, weathering, formation factors, and its profile and components.	1,2
II	Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity. Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability.	**12**	Gain knowledge of soil physical properties, taxonomy, water dynamics, air composition, temperature effects, and soil pH to understand their influence on plant growth and soil classification, including Indian soils.	1,2
III	Soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties	**6**	Understand soil colloids, silicate clays, ion exchange, soil organic matter, and humic substances, focusing on their composition, properties, and influence on soil behaviour.	1,3

IV	Soil organisms: macro and micro organisms, their beneficial and harmful effects.	**6**	Understand the role of soil organisms, both macro and micro, in soil health, focusing on their beneficial and harmful effects on soil properties and plant growth.	1,2
V	Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.	**3**	Learn about the behaviour of pesticides and inorganic contaminants in soil, and strategies for preventing and mitigating soil pollution to protect soil health.	2,3
Practical				
1	Study of soil profile in field	**30**	Understand soil horizons, properties, and their relevance to land use through field observation.	2,3
2	Study of soil sampling tools, collection of representative soil sample, its processing and storage		Learn to use soil sampling tools, collect representative samples, and process and store them properly for analysis.	2,3
3	Study of soil forming rocks and minerals		Identify and understand the types, properties, and roles of rocks and minerals in soil formation.	2,3
4	Determination of soil density, moisture content and porosity		Learn to measure soil density, moisture content, and porosity to assess soil structure and water-holding capacity.	3,4
5	Determination of soil texture by feel and Bouyoucos Methods		Learn to determine soil texture using the feel method and Bouyoucos hydrometer method for accurate classification of soil separates.	2,3
6	Studies of capillary rise phenomenon of water in soil column and water movement in soil		Understand the capillary rise phenomenon and study water movement through soil columns to assess soil's water retention and permeability.	2,3
7	Determination of soil pH and electrical conductivity		Learn to determine soil pH and electrical conductivity to assess soil acidity, alkalinity, and salinity levels for effective land management.	2,3
8	Determination of cation exchange capacity of soil		Learn to determine the cation exchange capacity (CEC) of soil to assess its ability to retain and exchange essential nutrients for plant growth.	3,4
9	Study of soil map		Understand how to interpret a soil map to analyse soil types, distribution, and suitability for various land uses.	2,3
10	Determination of soil colour		Learn to determine soil colour using Munsell chart to infer soil	2,3

			properties like organic matter, moisture, and mineral content.	
11	Demonstration of heat transfer in soil		Understand the process of heat transfer in soil and its impact on soil temperature and plant growth through practical demonstration.	2,3
12	Estimation of organic matter content of soil		Learn to estimate soil organic matter content to assess soil fertility, nutrient availability, and overall soil health.	3,4

TEXT BOOKS:

T1: Dilip Kumar Das. (2011) Introductory Soil Science, Kalyani Publishers, Ludhiana.
T2: Soil Science: An Introduction. (2015). Indian Society of Soil Science (ISSS)

REFERENCE BOOKS:

R1: Fundamental Soil Science. (2012). Indian Society of Soil Science (ISSS)

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Explain the processes of soil genesis, including the role of rocks, minerals, and weathering in soil formation, and identify components of soil profiles	1,2,4,6
2	Analyse soil physical properties (texture, structure, porosity, etc.) and classify soils using elementary taxonomy principles, including an overview of Indian soils	2,4
3	Understand soil water retention, movement, availability and the impact of soil air, temperature, and pH on plant growth and nutrient availability	1,2,4,6,7,8,12
4	Understand the concept of soil colloids, organic matter, and ion exchange processes	1,2,4,6,7,8
5	Explain strategies to prevent and mitigate soil pollution caused by pesticides and inorganic contaminants, incorporating sustainable soil management practices	1,2,4,6,7,8,9,11

SEMESTER – I									
Course Title	**Fundamentals of Plant Biochemistry and Biochemistry**								
Course Code	**23BSAG1106R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. Understand the fundamental biochemical processes in plants, including photosynthesis, respiration, and secondary metabolite production. 2. Explore modern biotechnological techniques such as genetic engineering, molecular markers, and plant tissue culture for crop improvement. 3. Develop analytical skills to evaluate plant metabolic functions and their applications in agriculture and biotechnology.								
CO1	Demonstrate a deep understanding of key plant biochemical pathways and their significance in plant growth and development.								
CO2	Apply biotechnological tools and techniques for crop improvement and sustainable agricultural practices								
CO3	Analyse plant metabolic processes and their biotechnological applications for enhancing plant traits.								
CO4	Utilise plant biochemistry and biotechnology knowledge to solve complex challenges in agriculture, food security, and environmental sustainability.								
CO5	Gain a holistic understanding of microbial diversity and its roles in agricultural ecosystems and human welfare and acquire practical laboratory skills for microbial culture, identification, and application in sustainable practices.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation, Structure of Disaccharides and Polysaccharides.	**6**	By the end of this lesson, students will understand the importance and classification of carbohydrates and identify their roles in biological systems. They will gain knowledge of the structural properties of monosaccharides, including their reducing and oxidising behaviours, and will be able to explain the concept of mutarotation. Additionally, students will learn to differentiate between the structures of disaccharides and polysaccharides, recognising their significance in various biological processes.	1,2
II	Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids	**6**	By the end of this lesson, students will understand the significance and classification of lipids and appreciate their essential role in biological systems. They will explore the structures and characteristics of fatty acids and distinguish between storage and membrane lipids. Furthermore, students will be capable of explaining how these	1,2

			lipids contribute to energy storage, membrane formation, and various cellular functions.	
III	Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.	**7**	Upon completing this topic, students will understand the importance and classification of nucleic acids, the structure of nucleotides, and the different forms of DNA (A, B, and Z). They will also explore the various types of RNA and their secondary and tertiary structures. Additionally, students will acquire knowledge of carbohydrate metabolism, including glycolysis, the TCA cycle, the glyoxylate cycle, the electron transport chain, and lipid metabolism, with a focus on beta-oxidation and fatty acid biosynthesis.	1,2
IV	Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, another culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its importance; somatic hybridisation and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant	**7**	Upon studying this topic, students will develop a comprehensive understanding of the concepts and applications of plant biotechnology, including its scope and various culture techniques such as organ, embryo, cell suspension, callus, anther, pollen, and ovule cultures. They will learn about micropropagation methods, organogenesis, embryogenesis, and the significance of synthetic seeds and embryo rescue. Students will also explore somatic hybridisation, cybrids, somaclonal variation for crop improvement, and cryopreservation.	2,3
V	DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.	**4**	Introduced to recombinant DNA methods, including physical, chemical, and Agrobacterium-mediated gene transfer methods. The importance of transgenics, PCR techniques, molecular markers (RFLP, RAPD, SSR), marker-assisted breeding, and biotechnology regulations in crop improvement will also be covered.	2,3
Practical				
1	Experiment on the preparation of solution, pH & buffers,	**30**	Students will learn to prepare solutions, adjust pH, and create buffers, enhancing their ability to manage and control experimental conditions in the laboratory.	2,3

2	Experiment on paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques.		Upon completing this topic, students will understand the principles and applications of paper chromatography and thin-layer chromatography (TLC) for the separation of amino acids and monosaccharides. They will also become familiar with various sterilization techniques, gaining insights into maintaining aseptic conditions in laboratory settings, which are essential for conducting accurate and reliable experiments in biological research.	2,3
3	Experiment on composition of various tissue culture media and preparation of stock solutions for MS nutrient medium.		After completing this topic, students will understand the composition of various tissue culture media and gain hands-on experience in preparing stock solutions for Murashige and Skoog (MS) nutrient medium. They will acquire knowledge of the essential components required for plant tissue culture and their roles in supporting plant growth and development in vitro, equipping them with practical skills for conducting tissue culture experiments.	2,3
4	Experiment on callus induction from various explants. Micro-propagation, hardening and acclimatisation.		Students will learn the process of callus induction from various explants, along with the techniques of micro-propagation, hardening, and acclimatisation for successful plant tissue culture.	2,3
5	Demonstration on isolation of DNA.		Through practical demonstration, students will acquire hands-on experience in isolating DNA, enhancing their skills in molecular biology techniques.	2,3
6	Demonstration of gel electrophoresis techniques and DNA finger printing.		Students will gain practical skills in gel electrophoresis techniques and DNA fingerprinting, enabling them to analyse and differentiate DNA samples effectively.	2,3
7	Experiment of qualitative tests of carbohydrates and amino acids		Students will develop the ability to perform and interpret qualitative tests for carbohydrates and amino acids, enhancing their skills in biochemical analysis.	2,3
8	Experiment on quantitative estimation of glucose/ proteins.		Students will gain proficiency in the quantitative estimation of glucose and proteins, improving their ability to measure and analyse these essential biomolecules accurately.	2,3

9	Experiment on titration methods for estimation of amino acids/lipids,		Students will master titration methods for the estimation of amino acids and lipids, enhancing their analytical skills in biochemical quantification.	2,3
10	Study the effect of pH, temperature and substrate concentration on enzyme action.		Students will understand how pH, temperature, and substrate concentration affect enzyme action, enabling them to analyse and optimize enzyme-mediated reactions.	2,3

TEXT BOOKS:

T1: Buchanan, B.B., Gruissem, W., and Jones,R.L. (2002). Biochemistry & Molecular Biology of Plants. Wiley Publishers

T2: Adrian Slater, Nigel Scott and Mark Fowler. (2008). Plant Biotechnology: The Genetic Manipulation of Plants. OUP Oxford Publishers.

REFERENCE BOOKS:

R1: J. Bonner and J. E. Varner (2014). *Principles of Plant Biochemistry.* Academic Press.

R2: Arie Altman and Paul Michael Hasegawa. (2012). Plant Biotechnology and Agriculture: Prospects for the 21st Century. Scientific Publishers.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate a deep understanding of key plant biochemical pathways and their significance in plant growth and development.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Apply biotechnological tools and techniques for crop improvement and sustainable agricultural practices	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Analyse plant metabolic processes and their biotechnological applications for enhancing plant traits.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Utilize plant biochemistry and biotechnology knowledge to solve complex challenges in agriculture, food security, and environmental sustainability.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Gain a holistic understanding of microbial diversity and its roles in agricultural ecosystems and human welfare and acquire practical laboratory skills for microbial culture, identification, and application in sustainable practices.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – I									
Course Title	**Rural Sociology and Educational Psychology**								
Course Code	**23BSAG1107R**	**Total Credits: 2** **Total Hours: 30T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To provide the students with a foundational knowledge on sociological aspects of rural people 2. To provide the students with a foundational knowledge on psychological aspects of rural people 3. To acquaint students with important features of rural society								
CO1	Understand concepts of rural sociology, its importance in agricultural extension activities								
CO2	Accustom to the characteristics of rural society, village institutions and social organizations								
CO3	Understand social groups, social stratification, culture, social values, social control, attitudinal Aspects of Rural People and can plan Social Change								
CO4	Understand the concepts of leadership, methods of selection & training of lay and professional leaders and use of local leaders in agricultural extension activities								
CO5	Understand concept of educational psychology, intelligence, personality, perceptions, emotions, frustration, motivation, teaching and learning & its relevance in agricultural extension								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Sociology and rural sociology, Extension Education, agricultural extension - meaning and definitions, Importance of rural sociology in agricultural extension and their interrelationship.	**6**	Understand the basics of sociology, rural sociology, and extension education, their definitions, and the importance of their interrelationship in agricultural extension.	1,2
II	Characteristics of Indian, rural society - differences and relationships between rural and urban societies Social group(s) - classification - formation and organization of groups role of social groups in agricultural extension	**6**	Understand the characteristics of Indian rural society, differences between rural and urban societies, social group classification, formation, and organization, and their role in agricultural extension.	1,2
III	Social stratification - meaning - forms - class system and caste system, Culture and different cultural concepts and their role in agricultural extension, Social Institution, Social values, social control & their role in agricultural extension, Social Interaction Process and Social Change & Development	**6**	Learn the concepts of social stratification, culture, social institutions, values, control, interaction, and their roles in agricultural extension, along with the processes of social change and development.	1,2

IV	Leadership - meaning - classification of leaders - roles of a leader and different methods in selection of a leader, Training of leaders - lay and professional leaders - advantages and limitations in using local leaders in agricultural extension	**6**	Understand the meaning, classification, and roles of leaders, methods for selecting leaders, training of lay and professional leaders, and the advantages and limitations of using local leaders in agricultural extension.	1,2
V	Psychology and educational psychology - meaning - scope and importance in agricultural extension, Behaviour: Cognitive, affective, psychomotor domain, personality, Attitude, Intelligence, Perception, Personality, emotions and frustration, Motivation - types of motives - theories of motivation, Learning, learning experience and learning situation, Principles of learning, Theories of learning, Implications of principles of learning in teaching - steps in extension teaching	**6**	Understand the meaning, scope, and importance of psychology and educational psychology in agricultural extension, focusing on behaviour domains, personality, attitude, motivation, learning theories, principles, and their application in effective extension teaching.	1,2

TEXT BOOKS:

T1: Mondal Sagar Narayan Sarju. (2017). Rural Sociology and Educational Psychology (Theory and Practice). Kayani Publishers, Ludhiana.

T2: Meena, D.K., Sharma, S., and Sharma, D. (2023). Introduction to Rural Sociology and Educational Psychology. Sr. Scientific Publications, Agra.

REFERENCE BOOKS:

R1: Adivi Reddy, A. (2006). Extension Education. Sree Lakshmi Press, Bapatla

R2: Chitamber, J.B. (1997). Introductory Rural Sociology. Wiley Eastern Limited, New Delhi.

R3: Daivadeenam, P. (2006). Educational Psychology in Agriculture. Agrotech Publishing Academy,Udaipur.

R4: Ray, G.L. 2006. Extension Communication and Management. Naya Prokash/Kalyani Publishers, Ludhiana.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand concepts of rural sociology, its importance in agricultural extension activities	1,9,10,11,12
2	Accustom to the characteristics of rural society, village institutions and social organizations	1,3,9,10,11,12
3	Understand social groups, social stratification, culture, social values, social control, attitudinal Aspects of Rural People and can plan Social Change	1,3,9,10,11,12
4	Understand the concepts of leadership, methods of selection & training of lay and professional leaders and use of local leaders in agricultural extension activities	1,3,9,10,11,12
5	Understand concept of educational psychology, intelligence, personality, perceptions, emotions, frustration, motivation, teaching and learning & its relevance in agricultural extension	1,3,9,10,11,12

SEMESTER – I									
Course Title	**Comprehension and Communication Skills In English**								
Course Code	**23BSAG1108R**	**Total Credits: 2** **Total Hours: 15T + 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	**1.** Develop the ability to comprehend and analyses various literary works, including articles and essays. **2.** Strengthen the writing skills through structured exercises, such as essays, reports and emails. **3.** Deepen understanding of English grammar rules and correct implementation in order to communicate with precision and accuracy.								
CO1	Acquire skills on essay writing and recall ideas from literary works to understand perspectives on societal, scientific, and linguistic topics.								
CO2	Interpret reading comprehension passages and identify the correct use of vocabulary, grammar, and contextual meanings.								
CO3	Use vocabulary and grammar rules effectively in written and spoken English, including constructing error-free sentences and essays.								
CO4	Differentiate between correct and incorrect usage of commonly confused words, sentence structures, and grammatical forms.								
CO5	Develop professional documents such as curriculum vitae, job applications, and synopsis writing, showcasing clarity, precision, and appropriateness.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Essays–War Minus Shooting–The Sporting Spirit, A Dilemma- A layman looks at science. Raymond. B. Fosdick and You and Your English– Spoken English and broken English G.B. Shaw	**4**	Analyse key themes and perspectives from essays to enhance critical thinking and comprehension skills.	1,2
II	Reading Comprehension and Vocabularies - Antonym, Synonym, Homophones, Homonyms, often confused words.	**2**	Develop reading comprehension skills and expand vocabulary by understanding antonyms, synonyms, homophones, homonyms, and often-confused words	1,2
III	Exercises to enrich vocabulary based on TOEFL and other competitive examinations.	**2**	Enhance vocabulary through exercises designed for TOEFL and other competitive exams to improve language proficiency.	2,3
IV	Functional Grammar – Articles and Preposition, Verb, Subject verb Agreement, Transformation, Synthesis and Direct and Indirect Narration	**4**	Master functional grammar concepts such as articles, prepositions, verbs, subject-verb agreement, sentence transformation, synthesis, and direct/indirect narration.	1,2
V	Preparation of Curriculum Vitae, Job applications and Synopsis Writing	**3**	Learn to prepare professional documents including curriculum vitae, job applications, and synopses for career advancement.	2,3

Practical				
1.	Listening Comprehension: Listening to short talk's lectures.	**30**	Develop listening comprehension skills by actively engaging with short talks and lectures to improve understanding and retention of spoken information.	1,2
2.	Listening to speeches (scientific, commercial and general in nature).		Enhance listening skills by understanding and analysing speeches of scientific, commercial, and general nature to improve comprehension and critical thinking.	1,2
3.	Oral Communication: Phonetics, stress and intonation.		Develop oral communication skills by understanding phonetics, stress patterns, and intonation to improve pronunciation and clarity in speech.	2,3
4.	Conversation practice.		Enhance conversational skills through practice to improve fluency, confidence, and effective communication in various contexts.	2,3
5.	Conversation: rate of speech, clarity of voice.		Improve conversation skills by focusing on an appropriate rate of speech and clarity of voice to ensure effective and confident communication.	2,3
6.	Conversation: speaking and Listening, politeness.		Enhance conversational skills by focusing on both speaking and listening with an emphasis on politeness to foster respectful and effective communication.	2,3
7.	Reading skills: reading dialogues, rapid reading, intensive reading, Improving reading skills.		Develop reading skills through practicing dialogue reading, rapid reading, intensive reading, and techniques to improve overall reading comprehension and speed.	2,3
8.	Mock Interviews: testing initiative and intellectual ability.		Prepare for mock interviews by testing initiative and intellectual ability, focusing on responding to questions with confidence, critical thinking, and problem-solving skills.	2,3
9.	Mock interviews: Testing team spirit and Leadership.		Prepare for mock interviews by assessing team spirit and leadership abilities, demonstrating effective collaboration, decision-making, and motivating others in group settings.	2,3
10.	Group Discussions.		Enhance communication and critical thinking skills through group discussions, focusing on articulating ideas, listening to others, and engaging in constructive debates.	2,3

TEXT BOOKS:

T1: Varinder Kumar and Bodh Raj. (2018). Comprehension & Communication Skills in English. Kalyani Publishers, Ludhiana.

REFERENCE BOOKS:

R1: Krishna Mohan and Meera Banerjee. (2009). Developing Communication Skills. Laxmi Publications.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Acquire skills on essay writing and recall ideas from literary works to understand perspectives on societal, scientific, and linguistic topics.	3,5
2	Interpret reading comprehension passages and identify the correct use of vocabulary, grammar, and contextual meanings.	3,5
3	Use vocabulary and grammar rules effectively in written and spoken English, including constructing error-free sentences and essays.	3,5
4	Differentiate between correct and incorrect usage of commonly confused words, sentence structures, and grammatical forms.	3,5
5	Develop professional documents such as curriculum vitae, job applications, and synopsis writing, showcasing clarity, precision, and appropriateness.	3,5

SEMESTER – I									
Course Title	**Agricultural Heritage**								
Course Code	**23BSAG1109R**	**Total Credits: 1** **Total Hours: 15T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To know about traditional farming techniques and knowledge. 2. To recognize agriculture's role in shaping culture and identity of various communities and regions. 3. To gain insights into the historical development of agriculture, including its impact on societies, economies and environment.								
CO1	Knowledge on agricultural heritage to connect with the history of agriculture								
CO2	Understand the rich agriculture heritage of India								
CO3	Integrate judicious traditional agricultural practices with modern methods								
CO4	Acquire knowledge of agricultural resources and its utilization								
CO5	Comprehend agricultural issues								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction of Indian agricultural heritage and relevance of heritage to present day agriculture. Globally important Agricultural Heritage System.	**3**	Study on ancient history of Agriculture and globally important agricultural heritage system	1,2
II	Past day agriculture and farmers in society: Indus period. Past day agriculture and farmers in society: Vedic period. Past day agriculture and farmers in society: Early historic/ Buddhist period.	**3**	Study on past day agriculture and farming system in different historic period	1,2
III	Classification of crops Crops and its importance Crop Voyage in India and World	**3**	Study on various types of crops their importance and introduction in India and other countries	1,2,3
IV	Plant production and protection through Indigenous Technical Knowledge (ITK) Agricultural resources and its Utilizations	**2**	Study on traditional method of crop management for different diseases, pests and other pests.	2,3
V	Agricultural Setup in India Current Scenario of Indian Agriculture Agriculture Scope Indian Agricultural Concern and Future Prospects	**4**	Study on Agriculture system in India, Current scenario, future prospect and scope of agriculture in India	1,2

TEXT BOOKS:

T1: Dr. Omprakash, Dr. Subodh Kumar. Agricultural Heritage. Rama Publication, New Delhi

T2: M.M Adhikary, Textbook of Agricultural Heritage, Daya Publishing, New Delhi

REFERENCE BOOKS:

R1: Nemraj Sunda, A competitive Book of Agriculture, Surahee Publication, Jaipur

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Knowledge on agricultural heritage to connect with the history of agriculture	1,2,3,4,5,6,7,10,12
2	Understand the rich agriculture heritage of India	1,2,3,4,5,6,7,8,10,11,12
3	Integrate judicious traditional agricultural practices with modern methods	1,2,3,4,5,6,7,8,9,10,11,12
4	Acquire knowledge of agricultural resources and its utilization	1,2,3,4,5,6,7,8,9,10,11,12
5	Comprehend agricultural issues	1,2,3,4,5,6,7,8,9,10,11,12

SEMESTER – I									
Course Title	**Introductory Biology**								
Course code	**24BSAG1110R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. To provide students with a comprehensive knowledge of the living world, including the diversity and characteristics of life, the origin of life, and the mechanisms of evolution 2. To equip students with the skills and knowledge necessary to effectively use binomial nomenclature and know about the structure and function of cell. 3. To identify and classify plants using morphological and anatomical characteristics.								
CO1	Comprehensive understanding of the fundamental principles of life, diversity and characteristics of living organisms and origin of life on Earth								
CO2	Develop knowledge on the processes of evolution and its significance in shaping the diversity of life								
CO3	Build proficiency in binomial nomenclature and classification for identifying and categorizing different species								
CO4	Deep understanding of plant biology, morphology of flowering plants, process of seed development, and germination								
CO5	Identification of essential contributions of animals in agriculture, including their role in crop pollination, pest control, and as sources of food and labour								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to the living world; Diversity and characteristics of life; Origin of life; Binomial nomenclature and classification	**3**	Comprehensive understanding of the fundamental principles of life, diversity and characteristics of living organisms and origin of life on Earth	1,2
II	Cell and cell division	**4**	Acquire knowledge about the cell structure, its function and cell division	1,2
III	Morphology of flowering plants; Seed and seed germination	**4**	Deep understanding of plant biology, morphology of flowering plants, process of seed development, and germination	1,2
IV	Plant systematic; Brassicaceae, Fabaceae and Poaceae	**2**	Understand the principles of plant systematics and taxonomy and also learn the major plant groups	1,2
V	Role of animals in agriculture	**2**	Identification of essential contributions of animals in agriculture, including their role in crop pollination, pest control, and as sources of food and labour.	1,2,3
Practical				
1	Morphology of flowering plants	**30**	Understand and identify the various structural parts and characteristics of flowering plants, aiding in the classification and study of plant diversity	2,3

2	Root, stem and leaf and their modifications		Learn to identify and understand the different forms and functions of roots, stems, and leaves in plants	2,3
3	Inflorescence		To acquire the knowledge to identify and understand the different types and arrangements of flowers on a plant	2,3
4	Flower and fruits		Learn to identify the parts of flowers and understand how they develop into fruits	2,3
5	Cell, tissues & cell division		Knowledge to identify different types of cells and tissues, and understand how cells divide and reproduce	2,3
6	Internal structure of root, stem and leaf		Learn to identify and understand the inner parts and functions of roots, stems, and leaves	2,3
7	Study of specimens and slides		Learn to observe and identify different biological samples under a microscope	2,3
8	Description of plants - Brassicaceae		Knowledge to recognize and describe the features of plants in the mustard family, Brassicaceae	1,2
9	Description of plants - Fabaceae		Learn to recognize and describe the features of plants in the legume family, Fabaceae	1,2
10	Description of plants - Poaceae		Knowledge to recognize and describe the features of plants in the grass family, Poaceae	1,2

TEXT BOOKS:

T1: A.C. Dutta. (1997). Botany for Degree Students.

REFERENCE BOOKS:

R1. Mackean, D.G. (1989). Introduction to Biology. Hodder Murray

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Comprehensive understanding of the fundamental principles of life, diversity and characteristics of living organisms and origin of life on Earth	1, 2, 4,6, 7, 9, 12
2	Develop knowledge on the processes of evolution and its significance in shaping the diversity of life	1, 2, 3, 4, 5, 6, 7, 8
3	Build proficiency in binomial nomenclature and classification for identifying and categorizing different species	1, 2, 4, 6, 7, 8, 11, 12
4	Deep understanding of plant biology, morphology of flowering plants, process of seed development, and germination	1, 2, 3, 4, 5, 6, 7, 8, 12
5	Identification of essential contributions of animals in agriculture, including their role in crop pollination, pest control, and as sources of food and labour	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – I									
Course Title	**Elementary Mathematics**								
Course Code	**23BSAG1110R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. The Elementary Mathematics course provides a thorough foundation in essential mathematical concepts. 2. To understand the arithmetic, algebra, geometry, calculus, developing problem-solving skills and mathematical reasoning. 3. With a focus on real-world applications, the course equips students with the fundamental skills necessary for future academic and practical pursuits.								
CO1	Learn the basic concept of Matrix including types and operations with its properties								
CO2	Understand and apply through simple problems on fundamental principle of counting, permutation and combination								
CO3	Build proficiency on principles of differentiation including rules, properties and methods of solution through numerical problems								
CO4	Strengthen basic concept of Integration, both of the indefinite and definite and how to solve various numerical, including area determination enclosed by simple curves								
CO5	Develop knowledge on basic concept of straight lines and curves generated from conic sections including equations and shapes								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Types of Matrices, Operations of addition, Scalar Multiplication and Multiplication of Matrices, Determinant of a Square Matrix, Minors and Cofactors, Transpose, adjoint and inverse of a matrix up to 3rd order.	**6**	Develop an understanding of different types of matrices, perform operations such as addition, scalar multiplication, and matrix multiplication, compute the determinant, minors, cofactors, transpose, adjoint, and inverse of matrices up to 3rd order, and apply these concepts to solve mathematical problems.	1,2
II	Fundamental principle of counting (FPC), Definitions and difference between Permutation and Combination, Formula for npr and ncr, simple problems.	**6**	Understand the Fundamental Principle of Counting (FPC), differentiate between permutations and combinations, apply the formulas for nPr and nCr, and solve simple problems related to these concepts.	1,2
III	Derivative and its meaning, Differentiation of algebraic, trigonometric, exponential & logarithmic functions, Rules of Differentiation, Differentiation by Substitution, Higher Order Differentiation, Maxima and Minima of Simple Functions.	**6**	Deep understanding the concept and meaning of derivatives, apply differentiation rules to algebraic, trigonometric, exponential, and logarithmic functions, perform higher-order differentiation and differentiation by substitution, and solve problems involving maxima and minima of simple functions.	1,2,3

IV	Integral as Anti-derivative process, Indefinite Integrals, Rules of Integration, Integration by substitution, Definite Integration, Properties of Definite Integral, Finding areas of Simple Closed Curves.	**6**	Understand integration as the anti-derivative process, compute indefinite and definite integrals using standard rules and substitution, apply the properties of definite integrals, and find the areas of simple closed curves.	1,2,3
V	2D Cartesian Co-ordinate system, Straight line: (Equation & Slope of a line), Circle: Equation of Circle, Equation to Tangent, Conic Sections: Focus, Eccentricity, Directrix, Axis of a conic section, Parabola & Ellipse: (Definitions, equations and shape of curve only).	**6**	Understand the 2D Cartesian coordinate system, analyse straight lines through their equations and slopes, derive and interpret the equations of circles and tangents, and comprehend conic sections by studying their focus, eccentricity, directrix, axis, and the definitions, equations, and shapes of parabolas and ellipses.	1,2,3

TEXT BOOKS:

T1: NCERT textbooks on Mathematics for Class XI and Class XII

REFERENCE BOOKS:

R1: Aggarwal, R.S. Mathematics for Class 11 and class 12. Bharti Bhawan publishers.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Learn the basic concept of Matrix including types and operations with its properties	4
2	Understand and apply through simple problems on fundamental principle of counting, permutation and combination	4,7
3	Build proficiency on principles of differentiation including rules, properties and methods of solution through numerical problems	4
4	Strengthen basic concept of Integration, both of the indefinite and definite and how to solve various numerical, including area determination enclosed by simple curves	7
5	Develop knowledge on basic concept of straight lines and curves generated from conic sections including equations and shapes	4,7

SEMESTER – I									
Course Title	**Human Values & Ethics**								
Course Code	**23BSAG1111R**	**Total Credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 15T	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/1st Semester of 1st Year of the Programme**								
Course Objectives	1. Inculcate principles and moral values of human existence and philosophy 2. Develop a comprehensive understanding of ethical theories and principles, enabling students to evaluate and apply them in diverse personal and professional situations 3. Cultivate moral reasoning and critical thinking skills, empowering students to make informed, ethical decisions and contribute positively to their communities and workplaces								
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.								
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.								
CO3	Understand the value of harmonious relationship based on trust and respect in their life and profession.								
CO4	Understand the role of a human being in ensuring harmony in society and nature.								
CO5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.								

Unit-No.	Content	Contact Hours	Learning Outcome	KL
I	Values and Ethics: An introduction, Goal and Mission of Life, Vision of Life, Principles and Philosophy of Life	**4**	Understand the concepts of values, ethics, and their importance in guiding personal goals, vision, and principles for a meaningful life.	1,2
II	Self-Exploration, Self-Awareness, Self-Satisfaction, Decision- making.	**3**	Explore self-awareness, self-satisfaction, and decision-making processes to enhance personal growth and effective life choices.	2,3
III	Motivation, Sensitivity, Success, Selfless Service	**2**	Understand the concepts of motivation, sensitivity, success, and selfless service, and how they contribute to personal development and positive societal impact.	2,3
IV	Positive Spirit, Body, Mind and Soul, Attachment and Detachment, Spirituality Quotient	**4**	Explore the relationship between body, mind, and soul, understanding the balance of attachment and detachment, and develop a deeper awareness of their spirituality quotient for holistic well-being.	2,3
V	Case Studies of Ethical Lives	**2**	Analyse case studies of ethical lives to understand the practical application of ethical principles and how they shape personal and professional decisions.	3,5

TEXT BOOKS:

T1: Barbara MacKinnon and Andrew Fiala. Ethics: Theory and Contemporary Issues.
T2: Russ Shafer-Landau. The Fundamentals of Ethics.
T3: R.S. Naagarazan. Values, Ethics, and Professional Conduct.

REFERENCE BOOKS:

R1: Scott B. Rae. Moral Choices: An Introduction to Ethics.
R2: James Rachels and Stuart Rachels. The Elements of Moral Philosophy.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	1,2,3,4,5,6,7,8,9,10,12
2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	1,2,3,4,9,10,12
3	Understand the value of harmonious relationship based on trust and respect in their life and profession.	1,2,3,5,6,7,8,9,10,11,12
4	Understand the role of a human being in ensuring harmony in society and nature.	1,2,3,4,5,6,7,8,9,10,12
5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	1,2,3,4,5,6,7,8,9,10,12

SEMESTER – I									
Course Title	**Physical Education and Yoga**								
Course Code	**24BSAG1112R**	**Total Credits: 1** **Total Hours: 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 1st Semester of 1st Year of the Programme**								
Course Objectives	1. The course provides a comprehensive exploration of various physical activities, including Football, Basketball, Kabaddi, Ball Badminton, and Table Tennis, alongside the practice of Yoga. 2. Students develop skills, strategies, and holistic health awareness. Emphasizing demonstration, practice, and correction 3. Instil lifelong habits of physical activity and wellness.								
CO1	Nurturing sportsmanship attitude among students								
CO2	Widening the sporting experience and enjoyment of each student								
CO3	Developing passion for active recreation and sport								
CO4	Assist students to realize their physical potential in a variety of sporting environments								
CO5	Encouraging healthy and active lifestyle								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Teaching Skills of football-demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit), Basketball demonstration, practice of the skills, correction of skills, involvement in game situation	**6**	To develop the ability to teach and demonstrate football and basketball skills effectively, provide practice opportunities, correct skill execution, and apply learned skills in game situations, with a focus on teaching Tennikoit specifically for girls.	2,3
II	Teaching Skills of Kabaddi, Ball Badminton, Table Tennis-demonstration, practice of the skills, correction of skills, involvement in game situation	**6**	To develop the ability to teach and demonstrate the skills of Kabaddi, Ball Badminton, and Table Tennis, provide practice opportunities, correct skill execution, and apply the skills effectively in game situations.	2,3
III	Teaching of some of Asanas – demonstration, practice, correction and practice	**6**	To gain the ability to teach, demonstrate, and guide the practice of various asana, provide corrections for proper alignment, and help learners develop proficiency through regular practice.	2,3
IV	Teaching – Meaning, Scope and importance of Physical Education	**6**	To understand the meaning, scope, and importance of physical education in promoting overall well-being, enhancing physical fitness, and fostering the development of various life skills.	2,3
V	Teaching – Definition, Type of Tournaments	**6**	To understand the definition of teaching, explore different types of tournaments, and recognize their structure and organization in the context of physical education and sports.	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Nurturing sportsmanship attitude among students	10
2	Widening the sporting experience and enjoyment of each student	10
3	Developing passion for active recreation and sport	10
4	Assist students to realize their physical potential in a variety of sporting environments	10
5	Encouraging healthy and active lifestyle	10

SEMESTER – I									
Course Title	**National Service Scheme I**								
Course Code	**23BSAG1113R**	**Total Credits: 1** **Total Hours: 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 1st Semester of 1st Year of the Programme**								
Course Objectives	1. To identify, understand and help in solving the needs and problems of the community 2. To develop competence required for group-living, sharing of responsibilities, cooperative attitude, and leadership quality 3. To gain skills in mobilizing community participation								
CO1	Transform into progressive citizens								
CO2	Indulge in nation-building activities								
CO3	Practice social and humanitarian skills								
CO4	Understand and find sustainable solutions for social problems								
CO5	Develop a social perspective of learning and build leadership skills								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction and basic components of NSS, NSS programmes and activities	**8**	Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteer's awareness about health. Concept of regular activities, special camping, day camps, basis of adoption of village/ slums, conducting survey, analysing guiding financial patterns of scheme, youth Programme/ schemes of GOI, coordination with different agencies and maintenance of diary	1,2
II	Understanding youth.	**4**	Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.	1,2
III	Community mobilization, Social harmony and national integration	**6**	Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership. Indian history and culture, role of youth in nation building, conflict resolution and peace-building	2,3
IV	Volunteerism and shramdan	**5**	Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism	2,3
V	Citizenship, constitution and human rights Family and society	**7**	Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Concept of family community(PRIs and other community based organisations) and society	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Transform into progressive citizens	6,10,11,12
2	Indulge in nation-building activities	6,10,11,12
3	Practice social and humanitarian skills	3,10,11,12
4	Understand and find sustainable solutions for social problems	3,6,10,11,12
5	Develop a social perspective of learning and build leadership skills	3,6,10,11,12

SEMESTER – II									
Course Title	**Fundamentals of Genetics**								
Course Code	**23BSAG1201R**	**Total Credits: 3** **Total Hours: 30T + 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To provide a solid foundation in genetics, laws of inheritance and molecular genetics. 2. To impart knowledge on the structure of cell and cell organelles, principles of genetics and their applications. 3. To acquaint with the fundamentals of chromosomal and cytoplasmic inheritance, mutations and chromosomal aberrations.								
CO1	Define key terms in genetics and recall the historical contributions of Gregor Mendel.								
CO2	Acquire knowledge about cell, different parts of cell and cell division.								
CO3	Acquire knowledge on deviation of monohybrid and dihybrid ratios.								
CO4	Understand transmission of traits, effect of change in chromosome number and structure, different types of traits and mutation.								
CO5	Acquire knowledge of genetic material, structure, replication, transcription, and protein synthesis and gene regulation.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity.	**2**	Learn about history of Genetics, Laws of Inheritance, Monohybrid cross and Dihybrid Cross.	1,2
II	Architecture of chromosome Chromonemata, chromosome matrix, chromomeres, centromere, Secondary constriction and telomere, Special types of chromosomes. Chromosomal theory of inheritance, Cell cycle ,Cell division- mitosis, meiosis	**8**	Gather knowledge about cell, parts of cell, cell division and types of chromosomes.	1,2
III	Probability and Chi-square, Dominance relationships, Epistatic interactions with example, Multiple alleles.	**5**	Learn about deviations for typical monohybrid and dihybrid ratios, multiple allelism and estimation of ratios.	2,3,4
IV	Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation Crossing over mechanisms Chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders.	**8**	Learn about transmission of characters, effect of change in chromosome number and structure, mutation and its various classifications, types of traits.	3,4

V	Nature, structure & replication of genetic material. Protein synthesis, Transcription mechanism of genetic material, Translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac operons, Trp operons	**7**	Gain knowledge about genetic material, their structure, replication, transcription and protein synthesis. Learn about gene regulation and structure.	1,2,3
Practical				
1.	Study of microscope.	**3**	Study different types of microscopes.	2,3
2.	Study of cell structure.	**3**	Study different parts of cell.	2,3
3.	Experiments on monohybrid cross	**3**	Solve numerical on monohybrid cross.	2,3,4
4.	Experiments on dihybrid cross	**3**	Solve numerical on dihybrid cross.	2,3,4
5.	Experiments on trihybrid, test cross and back cross	**3**	Calculate number of gametes in trihybrid cross and solve numerical on test cross and back cross.	2,3,4
6.	Experiments on epistatic interactions including test cross and back cross	**3**	Study epistasis and deviation in mendelian ratios.	2,3
7.	Practice on mitotic and meiotic cell division	**3**	Study on mitosis and meiosis.	2,3
8.	Experiments on probability and Chi-square test.	**2**	Study on probability and chi-square test.	2,3,4
9.	Determination of linkage and cross-over analysis (through two point test cross and three point test cross data).	**2**	Study linkage and cross over.	2,3
10.	Study on sex linked inheritance in Drosophila.	**2**	Study sex linked inheritance in Drosophila through different cross.	2,3
11.	Study of models on DNA structures.	**2**	Study structure of DNA.	2,3
12.	Study of models on RNA structures.	**1**	Study structure of RNA.	2,3

TEXT BOOKS:

T1: B.D. Singh (2022). Fundamentals of Genetics, Kalyani Publishers

REFERENCE BOOKS:

R1: B.D. Singh (2022). Genetics, Kalyani Publishers.

R2: E.J. Gardner, D.P., M.J. Simmons, D.P. Snustad (2006). Principles of Genetics, Wiley.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Define key terms in genetics and recall the historical contributions of Gregor Mendel.	1, 2,3,4,5,6,7,8,9,10,11,12
2	Acquire knowledge about cell, different parts of cell and cell division.	1, 2,3,4,5,6,7,8,9,10,11,12
3	Acquire knowledge on deviation of monohybrid and dihybrid ratios.	1, 2,3,4,5,6,7,8,9,10,11,12
4	Understand transmission of traits, effect of change in chromosome number and structure, different types of traits and mutation.	1, 2,3,4,5,6,7,8,9,10,11,12
5	Acquire knowledge of genetic material, structure, replication, transcription and protein synthesis and gene regulation.	1, 2,3,4,5,6,7,8,9,10,11,12

SEMESTER – II									
Course Title	**Fundamentals of Microbiology**								
Course Code	**24BSAG1202R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. Develop a comprehensive understanding of microbial diversity, including prokaryotic and eukaryotic microbes, bacterial metabolism, genetic recombination, and their roles in soil fertility, crop production, and biogeochemical cycles. 2. Explore the contributions of beneficial microbes such as Azolla, blue-green algae, and mycorrhiza to agricultural ecosystems and their interactions in the rhizosphere and phyllosphere. 3. Examine the applications of microbes in human welfare, including biofertilizers, biopesticides, silage production, biofuel generation, and biodegradation, focusing on sustainable practices.								
CO1	Demonstrate a thorough understanding of microbial diversity, bacterial genetics, and the roles of microbes in biogeochemical cycles, soil fertility, and crop production.								
CO2	Apply knowledge of beneficial microbes, such as Azolla, blue-green algae, and mycorrhiza, to enhance agricultural productivity and sustainability.								
CO3	Evaluate and implement microbial applications in human welfare, including bio fertilizers, bio pesticides, biofuel production, and waste biodegradation, contributing to eco-friendly practices.								
CO4	Acquire practical skills in microbiological techniques, including microscopy, sterilisation, media preparation, microbial isolation, and identification, preparing students for research and professional work in microbiology.								
CO5	Gain a holistic understanding of microbial diversity and its roles in agricultural ecosystems and human welfare and acquire practical laboratory skills for microbial culture, identification, and application in sustainable practices.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.	**3**	Understand the fundamental differences between prokaryotic and eukaryotic microbes, including their structural and functional characteristics and significance in the microbial world. Gain detailed knowledge of bacterial cell structure, growth mechanisms, and metabolic pathways, enabling the identification and understanding of their roles in diverse environments. Students will gain a comprehensive understanding of bacterial cell structure, including its unique components and functions, and the metabolic strategies employed by bacteria, such as chemoautotrophy and photo autotrophy. They will also develop insights into bacterial growth processes, including the factors influencing it and its	1,2

			relevance in natural ecosystems and applied microbiology.	
II	Bacterial genetics: Genetic recombination-transformation, conjugation and transduction, plasmids, transposon.	**3**	Students will acquire a thorough understanding of bacterial genetics, focusing on the mechanisms of genetic recombination, including transformation, conjugation, and transduction. They will also learn about the roles of plasmids and transposons in genetic variation, adaptability, and the transfer of genetic material, highlighting their significance in microbial evolution and biotechnology applications.	1,2
III	Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and sulphur cycles.	**3**	Students will understand the critical roles of microbes in enhancing soil fertility and supporting crop production by actively participating in biogeochemical cycles, including the cycling of carbon, nitrogen, phosphorus, and sulfur. They will learn how microbial processes contribute to nutrient availability, ecosystem sustainability, and agricultural productivity.	1,2
IV	Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue-green algae and mycorrhiza.	**3**	By the end of this module, students will gain a comprehensive understanding of biological nitrogen fixation, including symbiotic, associative, and asymbiotic processes, and the role of nitrogen-fixing microbes such as Rhizobium, Azolla, and blue-green algae.	1,2
V	Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilisers, biopesticides, biofuel production and biodegradation.	**3**	Learn about the importance of mycorrhizal fungi in nutrient acquisition and plant health and the significance of the rhizosphere and phyllosphere in supporting microbial life that benefits plants. Additionally, students will explore the use of microbes in human welfare, including silage production, biofertilisers, biopesticides, biofuel production, and biodegradation, understanding how these microbial applications contribute to sustainable agriculture, environmental management, and industrial advancements.	1,2,3
Practical				
1	Introduction to microbiology laboratory and equipment's; Microscope - parts, microscopy principles, resolving power and numerical aperture.	**30**	By completing this course, students will acquire a foundational understanding of microbiology laboratory practices and essential equipment, including the principles and operation of microscopes. They will learn about key microscopy concepts such as resolving power and numerical aperture, developing the ability to apply these techniques effectively for observing	2,3

			and analysing microbial samples. This course aims to enhance theoretical knowledge and practical skills in microbiological analysis, preparing students for advanced research and applications.	
2	Methods of sterilisation. Nutritional media and their preparations.		Microbiology laboratories require strict adherence to safety rules to prevent contamination and protect individuals. Key rules include: no eating, drinking, or smoking within the lab; proper hand hygiene before and after lab work; wearing appropriate protective gear (lab coats, gloves, eye protection); adequate disposal of contaminated materials; and strict aseptic techniques to prevent the spread of microorganisms.	2,3
3	Methods of sterilization. Nutritional media and their preparations.		By the end of this module, students will be able to understand and apply various sterilisation methods, including physical, chemical, and biological techniques, to ensure the eradication of microorganisms in laboratory and field settings. They will gain proficiency in selecting appropriate sterilisation methods, such as autoclaving, dry heat sterilisation, filtration, and chemical sterilants, based on specific requirements. Additionally, students will be able to prepare and formulate nutritional media for cultivating microorganisms, including agar-based media, liquid media, and specialised media for different microbial groups, ensuring proper preparation techniques for optimal growth conditions.	2,3
4	Enumeration of microbial population in soil bacteria, fungi, actinomycetes.		By the end of this module, students will be able to effectively enumerate and assess the microbial population in the soil, focusing on key groups such as bacteria, fungi, and actinomycetes. They will learn the techniques for isolating and counting these microorganisms using serial dilution, plate count techniques, and microscopic analysis, gaining the skills to interpret microbial diversity and abundance in soil ecosystems.	2,3
5	Methods of isolation and purification of microbial cultures.		By the end of this module, students will be able to apply various methods of isolation and purification of microbial cultures, including streak plate, pour plate, and spread plate techniques to obtain pure cultures from mixed microbial populations. They will also understand the use of selective media and	2,3

			differential media for isolating specific microorganisms and techniques like serial dilution and sub-culturing for further purification, ensuring the development of uncontaminated and viable microbial strains for research and application.	
6	Isolation of Rhizobium from legume root nodule. Isolation of Azotobacter from the soil.		By the end of this module, students will be able to effectively isolate Rhizobium from legume root nodules using selective media and incubation techniques, ensuring the identification and growth of these nitrogen-fixing bacteria. Additionally, students will learn the methods for isolating Azotobacter from soil samples, applying appropriate enrichment techniques and differential media to promote the growth of free-living nitrogen-fixing bacteria, and gain practical skills in identifying and maintaining pure cultures of these vital soil microbes.	2,3
7	Isolation of Azospirillum from roots. Staining and microscopic examination of microbes.		By the end of this module, students will be able to isolate Azospirillum from plant roots using selective enrichment techniques and appropriate media, ensuring the recovery of nitrogen-fixing bacteria associated with plant roots. Additionally, students will gain proficiency in staining techniques (such as Gram staining and spore staining) and microscopic examination of microbes, allowing them to identify and analyse the morphology, structure, and characteristics of microbial cultures under a microscope.	2,3

TEXT BOOKS:

T1: Prescott, Harley, and Klein. Microbiology. McGraw-Hill Education

T2: Ronald M. Atlas. Principles of Microbiology. McGraw-Hill Education

REFERENCE BOOKS:

R1: G. Rangaswami and D.J. Bagyaraj. Agricultural Microbiology. Prentice Hall India

R2: Eldor A. Paul. Soil Microbiology, Ecology, and Biochemistry. Academic Press

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate a thorough understanding of microbial diversity, bacterial genetics, and the roles of microbes in biogeochemical cycles, soil fertility, and crop production.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Apply knowledge of beneficial microbes, such as Azolla, blue-green algae, and mycorrhiza, to enhance agricultural productivity and sustainability.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Evaluate and implement microbial applications in human welfare, including bio fertilizers, bio pesticides, biofuel production, and waste biodegradation, contributing to eco-friendly practices.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Acquire practical skills in microbiological techniques, including microscopy, sterilisation, media preparation, microbial isolation, and identification, preparing students for research and professional work in microbiology.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Gain a holistic understanding of microbial diversity and its roles in agricultural ecosystems and human welfare and acquire practical laboratory skills for microbial culture, identification, and application in sustainable practices.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – II										
Course Title	**Manures, Fertilizers and Soil Fertility Management**									
Course Code	**23BSAG1203R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. Learn the principles of soil fertility, plant nutrition, and the essential criteria, roles, and interactions of nutrients 2. Understand the preparation, properties, and applications of organic manures, green manuring, chemical fertilizers, and soil amendments for sustainable nutrient management 3. Study the chemistry of major and micronutrients in soils, mechanisms of nutrient transport, and factors influencing nutrient use efficiency (NUE)									
CO1	Recall the principles of soil fertility, the classification of fertilizers, and the properties of essential plant nutrients									
CO2	Explain the role of organic manures, chemical fertilizers, and nutrient management strategies in enhancing soil fertility and plant growth									
CO3	Demonstrate the use of analytical instruments and techniques to estimate soil and plant nutrient content for effective soil management									
CO4	Analyse the relationship between soil properties, nutrient availability, and plant growth to assess soil health and nutrient deficiency									
CO5	Understand fertilizer recommendation plans based on soil test results, crop requirements, and environmental conditions to optimize nutrient use efficiency (NUE) in different agricultural systems									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Integrated Nutrient Management	**5**	Understand the importance of organic manures, their properties, preparation methods for bulky and concentrated manures, and the role of green/leaf manuring in Integrated Nutrient Management (INM).	1,2
II	Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order, Fertilizer Recommendation Approaches	**8**	Understand the classification, composition, and properties of major chemical fertilizers (nitrogenous, phosphatic, potassic, secondary, and micronutrient), as well as complex and nano fertilizers, soil amendments, fertilizer storage, and recommendation approaches under the Fertilizer Control Order.	1,2
III	History of soil fertility and plant nutrition. Criteria of essentiality. Role, deficiency and toxicity symptoms of essential plant nutrients. Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.	**5**	Learn the history of soil fertility and plant nutrition, the criteria of essentiality, the role, deficiency, and toxicity symptoms of essential plant nutrients, as well as the mechanisms of nutrient transport to plants and factors affecting nutrient availability.	1,2
IV	Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients	**5**	Understand the chemistry of essential soil nutrients including nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and micronutrients,	1,2

			and their interactions in the soil-plant system.	
V	Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, and rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.	**7**	Learn soil fertility evaluation techniques, soil testing methods, critical nutrient levels, and the forms of nutrients in soil. Understand plant analysis, rapid tissue tests, indicator plants, fertilizer recommendation methods, factors influencing nutrient use efficiency (NUE), and application methods for both rainfed and irrigated conditions.	2,3
Practical				
1	Introduction of analytical instruments and their principles, calibration and applications.	**30**	Knowledge of various equipments involved in soil and plant testing in a soil testing laboratory. Comprehensive idea of their working, principles such as colorimetry and flame photometry and calibration.	2,3
2	Estimation of soil organic carbon		Practical method of determining soil organic carbon using Walkley and Black's method.	2,3
3	Estimation of N in soils.		Practical knowledge of soil Nitrogen determination using Alkaline Potassium Permanganate method by Subbiah and Asija	2,3
4	Estimation of soil extractable in P soil.		Practical method of determination of soil available P using spectrophotometry.	2,3
5	Estimation of exchangeable K in soil.		Practical method of determination of exchangeable K in soil using flame photometry.	2,3
6	Estimation of exchangeable Ca and Mg in soil.		Practical knowledge of complexometric titration for determination of exchangeable Ca and Mg in soil.	2,3
7	Estimation of soil extractable S in soil		Knowledge of determining soil extractable sulphur using turbidimetric method.	2,3
8	Estimation of DTPA extractable micronutrients in soil		Knowledge of determining DTPA extractable in soil.	2,3
9	Estimation of N in plant		Knowledge of determination of N in plant samples.	2,3
10	Estimation of P in plant		Knowledge of determination of P in plant samples.	2,3
11	Estimation of K in plant		Knowledge of determination of K in plant samples.	2,3
12	Estimation of S in plant		Knowledge of determination of S in plant samples.	2,3

TEXT BOOKS:

T1: A. Rathinasamy. Manures, Fertilizers and Soil Fertility Management.

REFERENCE BOOKS:

R1: Dilip Kumar Das. (2011) Introductory Soil Science, Kalyani Publishers, Ludhiana.
R2: Fundamental of Soil Science. (2012). Indian Society of Soil Science (ISSS).

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Recall the principles of soil fertility, the classification of fertilizers, and the properties of essential plant nutrients	1,2,4,5,6,7,8,9,10,11,12
2	Explain the role of organic manures, chemical fertilizers, and nutrient management strategies in enhancing soil fertility and plant growth	1,2,3,4,5,6,7,8,9,10,11,12
3	Demonstrate the use of analytical instruments and techniques to estimate soil and plant nutrient content for effective soil management	1,2,3,4,5,6,7,8,10,11,12
4	Analyse the relationship between soil properties, nutrient availability, and plant growth to assess soil health and nutrient deficiency	1,2,3,4,5,6,7,10,11,12
5	Understand fertilizer recommendation plans based on soil test results, crop requirements, and environmental conditions to optimize nutrient use efficiency (NUE) in different agricultural systems	1,2,4,5,6,7,8,9,10,11

SEMESTER – II									
Course Title	**Fundamentals of Crop Physiology**								
Course Code	**23BSAG1204R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. Understand the structure and function of plant cells and organelles, and their role in plant growth and development. 2. Explore the key physiological and biochemical processes in plants, and the impact of plant nutrients and hormones on plant function. 3. Analyse the interaction between plants and their environment, focusing on how external factors influence plant physiology.								
CO1	Knowledge on the importance of plant physiology in agriculture in general.								
CO2	Understanding mechanisms of uptake, transport and translocation of water in plant and different physiological processes at plant and cellular levels.								
CO3	Acquiring knowledge about different physiological disorders of plant to deficiency and toxicity of nutrients and understanding the mechanism of nutrient uptake.								
CO4	Understanding the importance of growth regulators in plant growth and their effects on physiology.								
CO5	Knowledge of plant environment interaction and interpreting plant physiological growth parameters in terms of growth, development and yield.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to crop physiology and its importance in Agriculture. Plant cell: an Overview	**3**	Understanding the importance and future aspects of plant physiology in agriculture and learn about the cell, its organelles and their functions	1,2
II	Diffusion and osmosis; Absorption of water; Transpiration and Stomatal Physiology; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown	**4**	Understanding mechanisms of uptake, transport and translocation of water in plant and different physiological processes at plant and cellular levels.	1,2
III	Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients; Nutrient uptake mechanisms	**3**	Acquiring knowledge about different physiological disorders of plant to deficiency and toxicity of nutrients and understanding the mechanism of nutrient uptake.	1,2,3
IV	Plant Growth Regulators: Physiological roles and agricultural uses	**3**	Understanding the importance of growth regulators in plant growth and their effects on physiology	2,3

V	Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity	**2**	Knowledge of plant environment interaction and interpreting plant physiological growth parameters in terms of growth, development and yield	1,2
Practical				
1	Study of plant cells	**30**	Learn to identify parts of plant cells using a microscope and understand their functions.	2,3
2	Imbibition, Osmosis, Plasmolysis		To acquire knowledge about the water movements in plant cells through imbibition, osmosis, and plasmolysis	2,3
3	Structure and distribution of stomata, Measurement of root pressure, Rate of transpiration		To learn about structure of stomata, root pressure measurement, and transpiration rate in plants.	2,3
4	Separation of photosynthetic pigments through paper chromatography		Learn how to separate and identify different photosynthetic pigments in plants using paper chromatography	2,3
5	Photosynthesis		Learn how plants convert light energy into chemical energy through the process of photosynthesis.	2,3
6	Respiration		Know about the process of respiration	2,3
7	Tissue Test for mineral nutrients		Learn how to test and identify essential mineral nutrients in plant tissues	2,3,4
8	Estimation of relative water content		Learn how to measure and analyse the water content in plant tissues.	2,3,4
9	Measurement of photosynthetic CO_2 assimilation by Infra-Red Gas Analyser (IRGA).		Acquaint to measure the rate of photosynthesis by analysing CO_2 assimilation using an Infra-Red Gas Analyser (IRGA).	2,3

TEXT BOOKS:

T1: Lincoln Taiz and Eduardo Zeiger**,** Plant Physiology.

T2: F.B. Salisbury and C.W. Ross, Plant Physiology.

T3: Dr. V.K.Jain, Fundamentals of Plant Physiology.

REFERENCE BOOKS:

R1: Horst Marschner, Mineral nutrition of higher plants.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Knowledge on the importance of plant physiology in agriculture in general.	1,2,3,4,5,6,7,8,11,12
2	Understanding mechanisms of uptake, transport and translocation of water in plant and different physiological processes at plant and cellular levels.	1,2,3,4,5,6,7,8
3	Acquiring knowledge about different physiological disorders of plant to deficiency and toxicity of nutrients and understanding the mechanism of nutrient uptake.	1,2,3,4,5,6,7,8,12
4	Understanding the importance of growth regulators in plant growth and their effects on physiology.	1,2,3,4,5,6,7,8,9,11,12
5	Knowledge of plant environment interaction and interpreting plant physiological growth parameters in terms of growth, development and yield.	1,2,3,4,5,6,7,8,11

SEMESTER – II									
Course Title	**Fundamentals of Agricultural Economics**								
Course Code	**23BSAG1205R**	**Total Credits: 2** **Total Hours: 30T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. Understand the fundamental economic principles and concepts relevant to agriculture. 2. Analyse the structure and behaviour of agricultural markets, including supply and demand dynamics. 3. Evaluate the factors influencing agricultural production decisions and farm profitability.								
CO1	Interpret the importance, objective, scope, subject matter and approaches to economic analysis along with getting acquainted with the basic concepts of agricultural economics, planning, demand, elasticity of demand, consumer equilibrium and consumer surplus.								
CO2	To expose the students to production economics principles and their applications in agricultural decision making								
CO3	Understand the various concepts related to market and its functionaries and different factors that play a role in its proper functioning								
CO4	Provide overview of macroeconomic concepts like national income, population, money etc. and understand their application to analyse its implication								
CO5	Acquire basic knowledge on various concepts relating to agricultural and public finance with emphasis on banking, tax, VAT and different economic systems.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis, Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour, Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare, Agricultural economics: meaning, definition, characteristics, importance and its role in economic development, Agricultural planning and development in the country, Demand: meaning, law of demand, schedule and demand curve, determinants, Utility theory; law of diminishing marginal utility, equi-marginal utility principle, Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity, Consumer's equilibrium and derivation of demand curve, concept of consumer surplus.	**8**	Study on fundamental concepts of agricultural economics can help students to grasp the fundamental forces that determine the demand for agricultural products within the broader context of the economy. Students will learn about the concept of elasticity of demand and its significance in agricultural markets.	1,2

II	Production: process, creation of utility, factors of production, input output relationship, Laws of returns: Law of variable proportions and law of returns to scale, Cost: concepts, short run and long run cost curves, Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, Elasticity of supply.	**5**	Study on the aspect of production in economics should help the students in grasping the concepts of production functions, including the relationship between inputs (such as labour, capital, and land) and outputs (such as crops or livestock). They should be able to analyse how changes in inputs affect output levels.	1,2
III	Market structure: meaning and types of market, Basic features of perfectly competitive and imperfect markets.	**5**	Study on markets will help students to comprehend various prevalent market structures such as perfect competition, monopolistic competition, oligopoly, and monopoly. They should grasp how these structures influence pricing, output decisions, and market behaviour.	1,2
IV	National income: Meaning and importance, circular flow, concepts of national income accounting, Approaches to measurement of national income, difficulties in measurement of national income, Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, Current policies and programmes on population control, Money: Barter system of exchange and its problems, evolution, meaning, Functions of money, classification of money, supply, general price index, inflation and deflation, Banking: Role in modern economy, types of banks, Functions of commercial and central bank, credit creation policy.	**7**	Study on macroeconomic principles will help students to develop a solid understanding of how various concepts of national income, money, and banking systems intersect with agricultural activities in shaping the broader economic landscape.	1,2
V	Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, Public revenue and public expenditure, Tax: meaning, direct and indirect taxes, agricultural taxation, VAT, Economic systems: Concepts of economy and its functions, Important features of capitalistic, socialistic and mixed economies, elements of economic planning.	**5**	Study on finance, taxation and different economic systems and there relevance will help understand the role of the government and the effects of taxation and subsidy programs in a broader economic context in which it operates in the agricultural sector.	1,2

TEXT BOOKS:

T1: Dewett, K.K. and Chand, A. 1979. Modern Economic Theory. S. Chand and Co., New Delhi.
T2: Dewett, K.K. and Varma, J.D. 1986. Elementary Economics. S. Chand and Co., New Delhi.

REFERENCE BOOKS:

R1: Subba Reddy, S, Raghu Ram, P., Sastry, T.V.N. and Bhavani Devi, I. 2009. Agricultural Economics Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Interpret the importance, objective, scope, subject matter and approaches to economic analysis along with getting acquainted with the basic concepts of agricultural economics, planning, demand, elasticity of demand, consumer equilibrium and consumer surplus.	1,2,3,4,9,11,12
2	To expose the students to production economics principles and their applications in agricultural decision making	1,2,3,4,5,7,8,9,11,12
3	Understand the various concepts related to market and its functionaries and different factors that play a role in its proper functioning	1,2,3,4,9,11,12
4	Provide overview of macroeconomic concepts like national income, population, money etc. and understand their application to analyse its implication	1,2,3,4,7,8,9,11,12
5	Acquire basic knowledge on various concepts relating to agricultural and public finance with emphasis on banking, tax, VAT and different economic systems.	1,2,3,4,7,8,9,11,12

SEMESTER – II									
Course Title	**Fundamentals of Plant Pathology**								
Course Code	**24BSAG1106R**	**Total Credits: 4** **Total Hours: 45T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			3	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To understand the basic knowledge of plant pathology and related subjects in the current scenario of Indian and world Agriculture. 2. Develop an understanding of communication methods, resources utilization, identification and isolation of plant pathogens, and their economic management. 3. To study living, non-living and environmental causes of diseases or disorders of the plants.								
CO1	Interpret the importance, objective, scope and historical development of the subject Plant Pathology in India and world along with causes of plant diseases and acquaintance with the plant pathological laboratory facilities.								
CO2	Recall the major plant disease causing agents and their characters.								
CO3	Experiment with fungi, bacteria, virus, nematodes as plant pathogens and distinguish the symptoms developed by them, classify the modes of survival and dispersal of plant pathogens								
CO4	Explain the process of disease development and role of enzymes, toxins and growth regulators in disease development								
CO5	Relate plant disease epidemiology, compare the factors of plant disease epidemiology and principles of plant disease management including the role of fungicides, its classification and application.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology I. History of Plant Pathology II. History of Plant Pathology III. Symptoms, signs, and related terminology in Plant Pathology. Classification of plant diseases. Parasitic causes of plant diseases with examples: Fungi.	**8**	Understanding the importance, scope and primary objectives of Plant Pathology. Acquaintance with historical landmarks in development of Plant Pathology as a subject. Gaining knowledge on historical landmarks identifying fungi and bacteria as plant pathogens. Gaining knowledge on historical landmarks identifying virus, viroids and bacteria as plant pathogens. Gaining practical knowledge about various plant disease symptoms, signs and related terms used in plant pathology. Gaining knowledge on different types of plant diseases. Understanding basic biology of fungi as plant pathogen	1,2

II	Bacteria. Fastidious Vascular Bacteria, Phytoplasmas, Spiroplasmas. Viruses and Viroids. Algae and Protozoa. Phanerogamic plant parasites. Nematodes. Non-parasitic causes of plant diseases and symptoms.	**8**	Understanding basic biology of bacteria, FVB, phytoplasma and spiroplasmas as plant pathogen. Learning about various live plants as plant pathogens. To acquaint with plant pathological nematodes and symptoms produced by them. Learning the abiotic cause of plant diseases	1,2
III	Fungi: General characteristics, definition, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus. Reproduction in fungi. Nomenclature, Binomial system of nomenclature, rules of nomenclature. Classification of plant pathogenic fungi, key to divisions, sub-divisions, orders and classes. Bacteria and mollicutes: General morphological characters. Reproduction in bacteria. Classification of plant pathogenic bacteria. Virus: Nature, structure, replication and transmission. Classification of plant pathogenic virus. General morphology and reproduction of nematodes, classification, symptoms and nature of damage. Survival and dispersal of plant pathogens.	**12**	Gaining knowledge on detailed structure, life cycle and structures of fungi. Learning about the international naming system or fungi. Understanding reproduction in fungi. To know about classification in fungi. Understanding bacterial reproduction. Understanding bacterial classification. To know about structure, reproduction and classification of virus. To acquaint with plant pathological nematodes and symptoms produced by them. Understanding mechanisms of survival and dispersal of plant pathogenic fungi, bacteria, virus and nematodes	1,2
IV	Types of parasitism and variability in plant pathogens I, Types of parasitism and variability in plant pathogens II, Pathogenesis I, Pathogenesis II, Pathogenesis III, Role of enzymes, toxins and growth regulators in disease development, Defense mechanism in plants I, Defense mechanism in plants II, Plant disease epidemiology, Disease forecasting	**10**	Acquaint with different mechanisms of variability in plant pathogens. To understand the process of disease development. Understanding enzymes and toxins as weapon of plant pathogens in disease development. Plants defend themselves against plant pathogens. To learn about how environmental factors influence disease. Understand epidemiological factors to forecast disease	1,2
V	Principles and methods of plant disease management, IPM. Fungicides: Nature, chemical combination, mode of action and classification I. Fungicides: Nature, chemical combination, mode of action and classification II. Formulations of fungicides	**7**	To learn about fungicidal chemicals, their history, chemical combination, mode of action and formulations. Learning the principles of plant disease management	1,2

Practical				
1	Acquaintance with various laboratory equipments	**30**	To learn about the usage of various laboratory equipments	2,3
2	Acquaintance with general plant pathological field equipments		To learn about the usage of various field equipments	2,3
3	Study of disease symptoms and signs		Visual identification of disease specimen	2,3
4	Collection and preservation of disease specimen		Preparation of disease herbarium and learning of preservation techniques	2,3,6
5	Importance of sterilization: Sterilization of media and glassware		To learn the usage of hot air oven and autoclave.	2,3
6	Preparation of artificial media		Preparation of PDA and other artificial media	2,3
7	Isolation of plant pathogen		Culture of plant pathogens for the inoculation to host to learn about the Koch Postulate	2,3
8	Preparation of host for Koch's postulates			
9	Establishment of Koch's postulates			
10	General study of different structures of fungi		Microscopic study about structures of fungi, bacteria	2,3
11	Staining and identification of plant pathogenic bacteria			
12	Transmission of plant viruses		Learn about various modes of transmission of plant viruses through PowerPoint presentation	2,3
13	Study of phanerogamic plant parasites		Learn about various phanerogamic plant parasites through PowerPoint presentation	2,3
14	Study of fungicides and their formulations		Learn about various recommended, banned and Restricted pesticides, safe handling of pesticides, and preparation of pesticides.	2,3,4
15	Methods of pesticide application and their safe use			
16	Calculation of fungicide spray concentrations			
17	Study of morphological features of nematodes		Learn about the nematode morphology, extraction methods and mounting through PowerPoint presentation	2,3
18	Sampling and extraction of nematodes from soil			
19	Sampling and extraction of nematodes from plants			
20	Preparation of nematode mounting			

TEXT BOOKS:

T1: H. C. Dube (2014). A text book of Fungi, bacteria and viruses, Student Edition, Jodhpur.

REFERENCE BOOKS:

R1: G. N. Agrios (2005). Introduction to Plant Pathology. 5th edition

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Interpret the importance, objective, scope and historical development of the subject Plant Pathology in India and world along with causes of plant diseases and acquaintance with the plant pathological laboratory facilities.	1,2,3,4,5,6,7,8,9,10,11,12
2	Recall the major plant disease causing agents and their characters.	1,2,3,4,5,6,7,8,9,10,11,12
3	Experiment with fungi, bacteria, virus, nematodes as plant pathogens and distinguish the symptoms developed by them, classify the modes of survival and dispersal of plant pathogens	1,2,3,4,5,6,7,8,9,10,11,12
4	Explain the process of disease development and role of enzymes, toxins and growth regulators in disease development	1,2,3,4,5,6,7,8,9,10,11,12
5	Relate plant disease epidemiology, compare the factors of plant disease epidemiology and principles of plant disease management including the role of fungicides, its classification and application.	1,2,3,4,5,6,7,8,9,10,11,12

SEMESTER – II									
Course Title	**Production Technology for Fruits and Plantation Crops**								
Course Code	**23BSAG1207R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. The course explores principles and practices of cultivating and managing fruits and plantation crops. 2. Learn about varietal selection, propagation techniques, cultivation practices, pest and disease management, and post-harvest handling 3. Gain comprehensive knowledge to optimize yield and quality of fruit and plantation crop production								
CO1	Analysing the scope of cultivating fruits and plantation crops in different parts of India								
CO2	Gaining knowledge on specific propagation methods involved in production of fruits and plantation crops, realizing the importance of rootstocks in fruit cultivation								
CO3	Define package of practices followed for tropical, sub-tropical, temperate and arid fruit crops								
CO4	Recognize plantation crop growing technologies and the significance of regional minor fruits.								
CO5	Developing career interest in pomology and plantation crops sector								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Importance and scope of fruit and plantation crop industry in India, Importance and use of rootstocks	**2**	Understand the importance and scope of the fruit and plantation crop industry in India, along with the significance and applications of rootstocks in enhancing crop productivity and quality.	1,2
II	Production technology for cultivation of tropical fruit crops like Mango, Banana, Guava, Papaya, Sapota, Jackfruit and plantation crops like Coconut, Arecanut, Cashewnut, Tea, Coffee and Rubber	**5**	Acquire knowledge of the production technology for cultivating tropical fruit crops such as mango, banana, guava, papaya, sapota, and jackfruit, as well as plantation crops like coconut, arecanut, cashew nut, tea, coffee, and rubber, focusing on their agronomic practices, management, and productivity enhancement.	1,2,3
III	Production technology for cultivation of sub-tropical fruit crops like Citrus, Litchi, Pomegranate and Pineapple	**3**	Understand the production technology for cultivating subtropical fruit crops such as citrus, litchi, pomegranate, and pineapple, focusing on their agronomic practices, management techniques, and strategies to enhance yield and quality.	1,2,3

IV	Production technology for cultivation of tropical fruit crops like Apple, Grapes and Pear	**3**	Understand the production technology for cultivating temperate fruit crops such as apple, grapes, and pear, with a focus on their agronomic practices, management techniques, and improving yield and quality.	1,2,3
V	Production technology for cultivation of Ber and minor fruits of Assam	**2**	To gain knowledge of the production technology for cultivating Ber and minor fruits of Assam, focusing on their agronomic practices, management strategies, and techniques to enhance productivity and quality specific to the region.	1,2,3
Practical				
1	Identification of important Fruits and plantation crops	**30**	To develop the ability to identify important fruits and plantation crops, select suitable sites and planting systems, understand the use of plant growth regulators in fruit production, propagate fruit plants through seeds, identify garden tools and implements, recognize major pests, diseases, and physiological disorders of fruit crops, determine harvesting indices and methods, and gain practical insights through visits to commercial nurseries and orchards.	1,2,3
2	Site Selection and planting system for planting of fruit trees			
3	Use of Plant Growth Regulator (PGR) in fruit production			
4	Propagation of fruit plants through seeds			
5	Identification of different garden tools and implements			
6	Important pest and diseases of fruit crops			
7	Physiological disorders of fruit crops			
8	Harvesting indices and method of harvesting in fruit crops			
9	Visit to Commercial Nurseries and Orchards			

TEXT BOOKS:

T1: T.K. Chattopadhyay. A Textbook of Pomology, Volume-I, Kalyani Publishers, Ludhiana.
T2: T.K. Chattopadhyay. A Textbook of Pomology, Volume-II, Kalyani Publishers, Ludhiana.

REFERENCE BOOKS:

R1: P. Muthukumar., R. Selvakumar. (1957). Glaustas Horticulture, New Vishal Publication.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Analysing the scope of cultivating fruits and plantation crops in different parts of India	1,2,4,5,6,7,8,11
2	Gaining knowledge on specific propagation methods involved in production of fruits and plantation crops, realizing the importance of rootstocks in fruit cultivation	1,2,4,5,6,7,8,11
3	Define package of practices followed for tropical, sub-tropical, temperate and arid fruit crops	1,2,4,5,6,7,8,11
4	Recognize plantation crop growing technologies and the significance of regional minor fruits.	1,2,4,5,6,7,8,11
5	Developing career interest in pomology and plantation crops sector	1,2,4,5,6,7,8,9,11

SEMESTER – II										
Course Title	**Fundamentals of Agricultural Extension Education**									
Course Code	**23BSAG1208R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To provide the students with a fundamental knowledge on how the agricultural extension system performs in India 2. To get acquainted with development programmes in Rural India & to acquaint the students with transfer of technology in India 3. To develop the skills for preparation of Extension Programmes, Audio-Visual Aids during training and demonstration to farmers								
CO1	Analyse the role of agricultural extension in fostering agricultural and rural development, and articulate its significance in addressing community needs.								
CO2	Explain the structure and functioning of the extension system in India, and identify emerging trends in agricultural extension practices.								
CO3	Design a comprehensive plan for rural community development by applying appropriate methodologies to plan, execute, and evaluate extension programs effectively.								
CO4	Select and utilize appropriate communication tools and methods to transfer agricultural technology and demonstrate effective dissemination of agricultural information to target audiences.								
CO5	Develop an interest in agricultural journalism by creating informative and engaging content aimed at raising awareness about agricultural advancements and rural issues.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.	**5**	Understand the meaning, definition, types, scope, principles, and process of education and extension education, along with the objectives and systematic planning of extension programmes for effective community and rural development.	1,2
II	Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.).	**5**	Gain knowledge of the evolution of extension systems in India, understanding key extension efforts during the pre- and post-independence eras, along with various agricultural and rural development programmes launched by ICAR and the Government of India.	1,2

III	New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.	**5**	Understand emerging trends in agricultural extension, including privatization, cyber/e-extension, market-led and farmer-led extension, and expert systems, enabling them to apply modern approaches for effective agricultural knowledge dissemination and rural development.	1,2
IV	Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes	**8**	Understand the concepts, definitions, and principles of rural development, community development, and rural leadership, along with various government rural development programmes, extension administration, and the principles, functions, monitoring, and evaluation of extension programmes for effective implementation and impact assessment.	1,2
V	Transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication, Agriculture journalism; Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.	**7**	Learn the concepts, models, and methods of technology transfer, capacity building of extension personnel, extension teaching methods, ICT applications, communication principles and barriers, agricultural journalism, and the diffusion and adoption of innovations, enabling effective dissemination of agricultural knowledge and practices.	1,2,3
Practical				
1	A visit to understand the problems being encountered by the villagers/farmers.	**30**	Gain practical insights into rural challenges, data collection, and analysis through field visits, understanding the structure and functioning of Gram Panchayats, Cooperatives, NGOs, KVKs, SSKs, and ATICs, while also applying PRA techniques for effective village development planning.	2, 3, 4
2	Study the organization and functioning of Gram Panchayat.			
3	Study the organization and functioning of Cooperative.			
4	Study the organization and functioning of NGO.			
5	To visit and study of KVK. To visit and study of SSK.			
6	To visit and study of ATIC.PRA techniques and its application in planning of village development activities.			

TEXT BOOKS:

T1: Sunil, V.G. Fundamentals of Agricultural Extension. New Vishal Publications, New Delhi.

T2: Mondal, S. Fundamentals of Agricultural Extension Education, Kalyani Publishers.

REFERENCE BOOKS:

R1: Adivi Reddy, A. 2006. Extension Education. Sree Lakshmi Press, Bapatla.

R2: Ray, G.L. 2006. Extension Communication and Management. Naya Prokash/Kalyani Publishers, Ludhiana.

R3: ICAR. Handbook of Agricultural Extension

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Improve the ability to understand and analyse written texts, including articles, essays, and literature by obtaining a deeper grasp of diverse materials	11
2	Develop strong listening comprehension, enabling confident engagement with various spoken contexts, from formal presentations to casual conversations	11
3	Hone oral communication skills, focusing on pronunciation, fluency, and clear expression, facilitating effective communication in both formal and informal settings	3,8,11,12
4	Strengthen written communication through structured exercises, covering genres such as essays, reports, and emails, promoting clarity and coherence in written expression	3,7,11,12
5	Cultivate critical thinking skills through the analysis of texts, encouraging the evaluation of diverse perspectives and the ability to respond thoughtfully to complex ideas	3,11,12

SEMESTER – II									
Course Title	**Crop Production Technology – II (Rabi Crops)**								
Course Code	**23BSAG1209R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To study the origin, geographical distribution, economic importance of Rabi crops 2. To study about soil & climatic requirement, varieties, cultural practices of Rabi crops 3. To study about yield attributes and yield of Rabi crops								
CO1	Comprehend the fundamentals of crop production of Rabi cereals.								
CO2	Decide on the crops, fertilizers and irrigation measures for crop production of Rabi pulses.								
CO3	Plan for sustainable crop production of Rabi oilseed.								
CO4	Explain the techniques involved in crop production of sugar crops, medicinal and aromatic crops								
CO5	Explain the techniques involved in crop production of forage crops.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Importance, area, production and productivity of major cereal, pulses, oilseeds, sugar crops, medicinal & aromatic and forage crops. Crop production technology of Wheat. Crop production technology of Barley	**3**	Understand the importance, area, production, and productivity of major cereals, pulses, oilseeds, sugar crops, medicinal, aromatic, and forage crops, along with gaining knowledge of the crop production technologies for wheat and barley to enhance yield and sustainability.	1,2
II	Crop production technology of Chickpea. Crop production technology of Lentil. Crop production technology of Peas	**3**	Acquire knowledge of the crop production technologies for chickpea, lentil, and peas, focusing on their agronomic practices, management techniques, and strategies to improve yield, quality, and sustainability.	2,3
III	Crop production technology of Rapeseed. Crop production technology of Mustard. Crop production technology of Sunflower.	**3**	Understand the crop production technologies for rapeseed, mustard, and sunflower, focusing on their agronomic practices, nutrient and pest management, and techniques to enhance yield and oil quality.	2,3
IV	Crop production technology of Sugarcane. Crop production technology of Mentha. Crop production technology of Lemon grass. Crop production technology of Citronella.	**3**	Gain knowledge of the crop production technologies for sugarcane, mentha, lemongrass, and citronella, focusing on their agronomic practices, resource management, and techniques to optimize productivity, quality, and sustainability.	2,3

V	Crop production technology of Berseem Crop production technology of Lucerne Crop production technology of Oat	**3**	Understand the crop production technologies for berseem, lucerne, and oat, focusing on their agronomic practices, nutrient and water management, and strategies to enhance forage yield, quality, and sustainability.	2,3
Practical				
1	Sowing methods of wheat	**3**	Demonstrate understanding of various sowing methods for wheat to optimize yield and resource efficiency	2,3
2	Sowing methods of sugarcane	**3**	Understanding different sowing methods of sugarcane to enhance yield, optimize resources, and improve crop management.	2,3
3	Identification of weeds in Rabi season crops	**3**	Ability to identify common weeds in Rabi season crops, enhancing weed management and improving crop yield.	1,2
4.	Study of morphological characteristics of rabi crops	**3**	Understanding the morphological traits of rabi crops aids in crop identification, cultivation, and yield optimization.	2,3
5.	Study of yield contributing characters of rabi season crops	**3**	Understanding key yield-contributing traits in rabi season crops to improve productivity, management practices, and crop performance.	2,3
6.	Yield and juice quality analysis of sugarcane	**3**	Evaluate sugarcane yield, juice quality parameters, and their implications for production efficiency and sugar extraction.	2,3,5
7.	Study of important agronomic experiments of rabi crops at experimental farms	**3**	Understanding key agronomic practices and experimental findings to optimize rabi crop cultivation and productivity.	2,3
8.	Study of rabi forage experiments	**3**	Learning outcome: Understanding rabi forage crop cultivation, management practices, and their impact on yield.	2,3
9.	Oil extraction of medicinal crops	**3**	Understanding methods, techniques, and benefits of extracting essential oils from medicinal plants.	2,3,4
10.	Visit to the research station of related crops.	**3**	Understand crop research techniques, station facilities, and their role in agricultural advancements.	2,3

TEXT BOOKS:

T1: Prasad, R. 2017. Field crop production, Vol. 1 & 2. Food grain crops & commercial crops. ICAR, New Delhi

T2: Reddy, S.R., Nagamani, C. 2019. Principles of Crop Production, Kalyani Publication, New Delhi

REFERENCE BOOKS:

R1: Thavaprakash, N. Velayudham, K. 2020 Objective Agronomy. Kalyani Publication, New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Comprehend the fundamentals of crop production of Rabi cereals.	1,2,3,4,5,6,7,8,9,10,11,12
2	Decide on the crops, fertilizers and irrigation measures for crop production of Rabi pulses.	1, 2,3,4,5,6,7,8,9,10,11,12
3	Plan for sustainable crop production of Rabi oilseed.	1, 2,3,4,5,6,7,8,9,10,11,12
4	Explain the techniques involved in crop production of sugar crops, medicinal and aromatic crops	1, 2,3,4,5,6,7,8,9,10,11,12
5	Explain the techniques involved in crop production of forage crops.	1, 2,3,4,5,6,7,8,9,10,11,12

SEMESTER – II									
Course Title	**National Service Scheme II**								
Course Code	**23BSAG1210R**	**Total Credits: 1** **Total Hours: 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To explore the meaning, types, and traits of leadership and understand the role of youth leadership in fostering societal change 2. To develop life competencies such as problem-solving, decision-making, and interpersonal communication to address real-world challenges 3. To analyse the development and impact of youth development programs and policies at national, state, and voluntary levels.								
CO1	Understand the different types, traits, and qualities of leadership, with a focus on the importance and role of youth leadership in driving social change								
CO2	Gain knowledge of life competencies and apply problem-solving, decision-making, and interpersonal communication skills to real-life situations								
CO3	Analyse and evaluate youth development programs and policies at the national, state, and voluntary levels, with an emphasis on youth-led organizations								
CO4	Comprehend the importance of health education, hygiene, nutrition, and sanitation, and their relevance in promoting public health and preventing diseases								
CO5	Gain awareness of youth health issues, including HIV/AIDS, lifestyle choices, and first aid practices, and understand yoga's role in promoting mental and physical well-being								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Importance and role of youth leadership. Meaning, types and traits of leadership, qualities of good leaders, importance and role of youth leaderships	**8**	Learn the importance of youth leadership in driving personal growth, fostering ethical decision-making, and promoting social and community development. An understanding of key leadership skills, including communication, teamwork, and critical thinking, and apply these to address real-world challenges effectively and inclusively.	2,3
II	Life competencies: Definition and importance of life competencies, problem solving and decision making, inter-personal communication	**8**	Definition and significance of life competencies, including their role in personal and professional success. Develop foundational skills in problem-solving, decision-making, and interpersonal communication, enabling them to navigate challenges, make informed choices, and build meaningful relationships effectively.	2,3
III	Youth Development Programmes: Development of youth programmes and policy at national level, state level and voluntary sector, youth-focused and youth-led organizations.	**4**	Understanding of the development and implementation of youth programs and policies at national, state, and voluntary levels. Analyse the role of youth-focused	2,3,4

			and youth-led organizations in addressing youth needs, fostering leadership, and promoting active participation in societal development.	
IV	Health, hygiene and sanitation: definition, need and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachch Bharat Abhiyan) for health, national health programme and reproductive health. Youth health, lifestyle, HIV AIDS and first aid	**4**	Definition, need, and scope of health education, emphasizing the role of nutrition, safe drinking water, sanitation, and hygiene in maintaining health. Understand the impact of waterborne diseases and national health programs, including initiatives like Swachh Bharat Abhiyan, on public health and reproductive health awareness. Understand the importance of youth health and lifestyle choices in promoting overall well-being. Knowledge of HIV/AIDS prevention and management, as well as develop basic first aid skills to respond effectively to emergencies.	2,3
V	Youth and yoga: History, Philosophy, Myths and misconceptions about yoga, yoga traditions and its impacts, yoga as a tool for a healthy lifestyle, preventive and curative method	**6**	The history, philosophy and traditions of yoga, addressing myths and misconceptions. Understand yoga's role as a tool for promoting a healthy lifestyle and its preventive and curative benefits for physical and mental well-being	1,2

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the different types, traits, and qualities of leadership, with a focus on the importance and role of youth leadership in driving social change	3,10,11
2	Gain knowledge of life competencies and apply problem-solving, decision-making, and interpersonal communication skills to real-life situations	3,5,10,11
3	Analyse and evaluate youth development programs and policies at the national, state, and voluntary levels, with an emphasis on youth-led organizations	10,11
4	Comprehend the importance of health education, hygiene, nutrition, and sanitation, and their relevance in promoting public health and preventing diseases	3,5,11
5	Gain awareness of youth health issues, including HIV/AIDS, lifestyle choices, and first aid practices, and understand yoga's role in promoting mental and physical well-being	3,5,10,11

SEMESTER – II									
Course Title	**Implicit English**								
Course Code	**23UBPD122R**	**Total Credits: 2** **Total Hours: 60P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 2nd Semester of 1st Year of the Programme**								
Course Objectives	1. To develop a clear understanding of sentence transformation and uses of tenses to communicate effectively and accurately. 2. To strengthen and expand the vocabulary of the students which will help students in writing, speaking, and correct common grammatical errors in English. 3. To improve vocabulary for concise and effective communication.								
CO1	Apply correct tenses in written and spoken communication								
CO2	Apply effective listening and reading techniques, including the SQ3R method, for better comprehension and information retention								
CO3	Rectify common errors in grammar, spelling, and sentence construction								
CO4	Grasp and manage time effectively by understanding its importance								
CO5	Know different effective strategies to meet academic and personal goals								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Unit-1 Grammar (flipped classroom)** • Interchange of Interrogative and Assertive Sentences, Exclamatory and Assertive Sentences. • Types of Tenses • Common Errors **Unit 1.2 Measurement** • Concept of Circumference, Area of different shapes • Concept of volume of different	**12**	Apply correct tenses in written and spoken communication	1,2
II	**Unit-2 Vocabulary Development** • One word substitution • Homonyms and Homophones • Words often confused • Idioms and phrases **Unit- 2.2 Interest, CI and SI and discount** • Discount • Concept of SI and CI • Difference between SI and CI	**12**	Apply effective listening and reading techniques, including the SQ3R method, for better comprehension and information retention	1,2
III	**Unit -3 Listening Skills** • What is listening? • Types of Listening • Understanding Listening Barriers **Unit 3.2 Syllogism** • Problem-solving techniques by using the ven diagram	**12**	Rectify common errors in grammar, spelling, and sentence construction	1,2,3

IV	**Unit- 4 Reading Skills** • Techniques of Effective Reading • Gathering ideas and information from a text • The SQ3R Technique **Unit 4.2 Age and average** • Concept of ages and Averages • Short tricks to solve problems • 3. Example and exercise	**12**	Grasp and manage time effectively by understanding its importance	2,3
V	**Unit-5 Time-Management Skills** • Introduction to Time Management • Purpose and Importance of Time Management • Basic Tips to Maintain Time **Unit-5.2 Creation of LinkedIn Profile**	**12**	Know different effective strategies to meet academic and personal goals Learn to create a professional LinkedIn profile by effectively showcasing skills, education, experience, and achievements to build a strong online professional presence	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Apply correct tenses in written and spoken communication	3,5
2	Apply effective listening and reading techniques, including the SQ3R method, for better comprehension and information retention	3,5
3	Rectify common errors in grammar, spelling, and sentence construction	3,5
4	Grasp and manage time effectively by understanding its importance	3,5
5	Know different effective strategies to meet academic and personal goals	3,5

SEMESTER – III									
Course Title	**Crop Production Technology – I (Kharif Crops)**								
Course Code	**23BSAG2101R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**		**Nil**					
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. To study the origin, geographical distribution, economic importance of Kharif crops 2. To study about soil & climatic requirement, varieties, cultural practices of Kharif crops 3. To study about yield attributes and yield of Kharif crops								
CO1	Comprehend the fundamentals of crop production of Kharif cereals								
CO2	Decide on the crops, fertilizers and irrigation measures for crop production of Kharif pulses								
CO3	Plan for sustainable crop production of Kharif oilseed								
CO4	Explain the techniques involved in crop production of fiber and forage crops								
CO5	Correlate parameters involved in crop cultivation and practice Kharif crop cultivation								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Crop production technology of cereal crop - Rice Crop production technology of cereal crop - Maize Crop production technology of cereal crop - Sorghum Crop production technology of cereal crop - Pearl millet Crop production technology of cereal crop - Finger millet	**5**	To understand cultivation practices, soil and climatic requirements, planting techniques, irrigation, pest and disease management, harvesting, and yield optimization for these crops.	2,3
II	Crop production technology of pulse crop- pigeon pea/ red gram Crop production technology of pulse crop - mung bean and urdbean	**3**	To understand optimal cultivation practices, including soil preparation, sowing methods, irrigation, nutrient management and pest control. This knowledge enhances yield, quality, and sustainable agricultural practices for these crops.	2,3
III	Crop production technology of oilseed crop - Groundnut Crop production technology of oilseed crop - Soya bean	**2**	To understand optimal cultivation practices, including soil preparation, sowing methods, irrigation, nutrient management and pest control.	2,3
IV	Crop production technology of fibre crop- Cotton Crop production technology of fibre crop- Jute	**2**	To understand advanced agronomic practices, soil management, pest control, yield optimization, and sustainable cultivation techniques to enhance productivity and profitability.	2,3

V		Crop production technology of forage sorghum Crop production technology of forage cowpea Crop production technology of forage cluster bean Crop production technology of forage napier.	**3**	To equips students with knowledge of cultivation practices, soil and nutrient management, pest control, and harvesting techniques to enhance yield, quality, and sustainability.	2,3
Practical	**1**	To study about the rice nursery preparation	**30**	Study on preparing rice nurseries, focusing on seedbed preparation, soil management, and nursery care.	2,3
	2	To study about the transplanting of rice		Study on the methods, techniques, and benefits of rice transplanting for optimal growth.	2,3
	3	To study about the sowing of Kharif pulses		Study on techniques and methods for sowing Kharif pulses for optimal growth.	2,3
	4	To study about the sowing of Kharif oilseeds		To understand the techniques, timing, and benefits of sowing Kharif oilseeds for optimal yield.	2,3
	5	To study about the effect of various seed size on germination and seedling vigour		To understand how different seed sizes affect germination rates and seedling vigour.	2,3
	6	To study about the effect of sowing depth on seed germination of Kharif crops		To understand the impact of sowing depth on seed germination and growth of Kharif crops.	2,3
	7	To study about identification of weeds in Kharif season crops		Identify and classify weeds in Kharif season crops to enhance effective weed management practices.	1,2,3
	8	To study about top dressing and foliar application of nutrients		To understand the principles and practices of top dressing and foliar nutrient application for improved crop growth.	2,3
	9	To study about yield attributing characteristics and yield calculation of Kharif crops		To explore yield attributing characteristics and calculate the yield of Kharif crops.	2,3,4
	10	To study of crop varieties and important agronomic experiments at experimental farm		To explore crop varieties and conduct key agronomic experiments at the experimental farm for practical understanding.	2,3

	11	To study about various forage experiments		The course outcome is to understand and analyse different forage experiments for improved agricultural practices and livestock nutrition.	2,3
	12	To study about the morphological description of various Kharif season crops		Understand the morpho-logical characteristics and description of various Kharif season crops.	2,3
	13	Visit to the research station of related crops		Understand crop research practices and gain hands-on experience in crop management and innovation.	2,3

TEXT BOOKS:

T1: Prasad, R. 2017. Field crop Production, Vol. 1 & Vol. 2 (Food grain crops & Commercial crops). ICAR, New Delhi.

REFERENCE BOOKS:

R1: Reddy, S.R., Nagamani, C. 2022. Principles of Crop Production, Kalyani Publication, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Comprehend the fundamentals of crop production of Kharif cereals	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Decide on the crops, fertilizers and irrigation measures for crop production of Kharif pulses	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Plan for sustainable crop production of Kharif oilseed	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Explain the techniques involved in crop production of fibre and forage crops	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Correlate parameters involved in crop cultivation and practice Kharif crop cultivation	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER- III									
Course Title	**Fundamentals of Plant Breeding**								
Course Code	**23BSAG2102R**	**Total Credits: 3** **Total Hours: 30T + 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. To provide a solid foundation in plant breeding, modes of reproduction and heterosis. 2. To impart knowledge on the principles and procedures of plant breeding in self-pollinated crops. 3. To impart knowledge on the principles and procedures of plant breeding in cross-pollinated crops.								
CO1	Gain knowledge about the objectives, achievements and prospects of plant breeding.								
CO2	Acquire knowledge about modes of reproduction, consequences of apomixes, self-incompatibility and male sterility.								
CO3	Understand different methods of breeding of self-pollinated, cross-pollinated and asexually propagated crops.								
CO4	Learn about biotechnological tools including DNA markers and their importance in Marker Assisted Selection.								
CO5	Understand the importance and different types of Intellectual Property Rights.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Historical development, concept, nature and role of plant breeding; Major achievements and future prospects; Genetics in relation to plant breeding.	**3**	Learn about history of plant breeding, achievements and future prospects.	1,2
II	Modes of reproduction -Apomixes, Self-incompatibility-genetic consequences, cultivar options, Male sterility- genetic consequences, cultivar options, Domestication, Acclimatization and Introduction, Centres of origin/ diversity, Components of Genetic variation, Heritability and genetic advance	**8**	Gather knowledge about different modes of reproduction in plants, centre of origin, plant introduction and genetic consequences of male sterility and self-incompatibility.	1,2
III	Genetic basis and breeding methods in self-pollinated crops - mass and pure line selection; Hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law Genetic basis and methods of breeding cross pollinated crops, modes of selection Population improvement Schemes: Ear to row method, Modified Ear to Row Recurrent selection schemes Heterosis and inbreeding depression, Development of inbred lines and hybrids, composite and synthetic varieties	**9**	Learn about different methods for breeding of self and cross-pollinated crops.	1,2

IV	Breeding methods in asexually propagated crops, clonal selection and hybridization Maintenance of breeding records and data collection Wide hybridization and pre-breeding Polyploidy in relation to plant breeding Mutation breeding-methods and uses Breeding for important biotic stresses Breeding for important abiotic stresses	**7**	Learn about breeding for asexually propagated crops, biotic and abiotic stress, and mutation breeding and polyploidy in plant breeding.	2,3
V	Biotechnological tools-DNA markers Marker-assisted selection Participatory plant breeding Intellectual Property Rights Patenting Plant Breeders and Farmer's Rights	**3**	Gain knowledge about use of biotechnological tools in plant breeding and importance and types of Intellectual Property Rights.	2,3
Practical				
1.	Plant Breeder's kit	**30**	Learn different tools used by a plant breeder.	1,2
2.	Study of germplasm of various crops		Study germplasm collection and utilization.	2,3
3.	Study of floral structure of self-pollinated and cross pollinated crops		Study floral structure of various crops.	2,3
4.	Emasculation and hybridization techniques in self and cross-pollinated crops		Learn emasculation techniques in various crops.	2,3
5.	Consequences of inbreeding on genetic structure of resulting populations		Learn the consequences of inbreeding.	2,3
6.	Study of male sterility system		Study the types and consequences of male sterility.	2,3
7.	Handling of segregation populations		Learn how to maintain segregation populations	2,3
8.	Methods of calculating mean, range, variance, standard deviation, heritability.		Understand how to calculate mean, range, standard deviation and heritability.	2,3
9.	Designs used in plant breeding experiments,		Learn different designs used in plant breeding.	2,3
10.	Analysis of Randomized Block Design.		Learn about Randomized Block Design	1,2,3
11.	To work out the mode of pollination in a given crop and extent of natural out-crossing.		Learn about modes of pollination.	2,3
12.	Prediction of performance of double cross hybrids.		Learn about the performance of double cross hybrids.	2,3

TEXT BOOK:

T1: Singh,P. (2017). Fundamentals of Plant Breeding. Kalyani Publishers.

REFERENCE BOOKS:

R1: Singh, B.D. 2022. Plant Breeding: Principles and methods, Kalyani Publishers

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Gain knowledge about the objectives, achievements and prospects of plant breeding.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Acquire knowledge about modes of reproduction, consequences of apomixes, self-incompatibility and male sterility.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Understand different methods of breeding of self-pollinated, cross-pollinated and asexually propagated crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Learn about biotechnological tools including DNA markers and their importance in Marker Assisted Selection.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Understand the importance and different types of Intellectual Property Rights.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – III									
Course Title	**Agricultural Finance and Cooperation**								
Course Code	**23BSAG2103R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. Introduction to agricultural finance and providing an overview of the importance of finance in agricultural operations covering basic financial concepts and tools relevant to the agricultural sector. 2. Gaining knowledge of credit analysis, various institutional and non-institutional sources of agricultural finance and higher financing institutions. 3. Acquiring knowledge and skills needed to understand the principles of agricultural cooperation, management practices, and the role of cooperatives in agricultural development in India.								
CO1	Introduction to agricultural finance and providing an overview of the importance of finance in agricultural operations covering basic financial concepts and tools relevant to the agricultural sector.								
CO2	Gaining knowledge of credit analysis and various institutional and non-institutional sources of agricultural finance.								
CO3	Acquiring comprehensive understanding of various types of higher financing institutions along with the functions and services provided by higher financing institutions.								
CO4	Understanding the components of financial statements including balance sheet, income statement, their preparation, analysis, and interpretation.								
CO5	Acquiring knowledge and skills needed to understand the principles of agricultural cooperation, management practices, and the role of cooperatives in agricultural development in India.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's and 7 P's of credit, repayment plans, Determination of most profitable level of capital use, Optimum allocation of limited amount of capital among different enterprise.	**7**	Study on fundamental concepts of agricultural finance will help in gaining insights into the role of credit in improving agricultural productivity, the types of agricultural credit available and credit analysis. Additionally, learners will explore the principles and plans of loan repayment.	1,2
II	Sources of Agricultural Finance: Institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, micro financing including KCC, Lead Bank Scheme, RRBs, Scale of finance and unit cost.	**6**	Learners will explore various sources of agricultural finance, including institutional sources as well as non-institutional sources. They will understand the significance of social control and nationalization of banks in ensuring equitable access to credit for farmers. Additionally, learners will examine microfinancing as a tool for providing financial inclusion,	1,2,3

			with a focus on key initiatives to support smallholder farmers.	
III	An Introduction to Higher Financing Institutions: RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India, cost of credit, Recent development in Agricultural credit.	**5**	Study of higher financing institutions like NABARD, RBI etc. will enable learners in understanding their role in providing long-term credit and facilitating agricultural growth. They will explore recent developments in agricultural credit, including technological advancements aimed at improving access to finance for farmers.	1,2,3
IV	Preparation and Analysis of Financial Statements: Balance sheet, Income statement, Basic Guidelines for Preparation of Project Reports, Bank norms, SWOT analysis, Techno-economic parameters for preparation of projects, Preparation of Bankable projects for various agricultural products and its value- added products.	**4**	Knowing about financial analysis will help equip learners with the tools necessary for financial management, gaining comprehensive skills in financial analysis, project preparation and developing the ability to interpret financial statements for decision-making and also acquire critical thinking and analytical skills for SWOT-based strategy development.	1,2,3
V	Agricultural Co-operation: Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian Agriculture, Credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing, Role of ICA, NCUI, NCDC, NAFED.	**8**	Develop a comprehensive understanding of how agricultural cooperatives operate in India and gain insights into the various types of cooperatives, their roles in addressing challenges faced by farmers. Additionally, understand the importance of cooperative principles, history, and various institutions (ICA, NCUI, NCDC, NAFED) in promoting sustainable development and also recognize the success of cooperative models like AMUL and apply the principles.	2,3
Practical				
1	Basic terms related to Agricultural Finance and Co-operation	**30**	Study of fundamental terms related to agricultural finance and cooperation, enabling the students to analyse financial aspects and cooperative structures in the agricultural sector.	1,2
2	Determination of most profitable level of capital use		Students will learn to analyse the relationship between capital investment and returns, identifying the optimal level of	1,2

			capital use for maximizing profitability in agricultural production.	
3	Optimum allocation of limited amount of capital among different enterprise		Students will understand how to efficiently allocate limited capital among various enterprises to maximize returns.	2,3
4	Preparation and analysis of balance sheet – A case study		Students will learn to prepare and analyse a balance sheet through a case study approach, gaining practical insights into financial position assessment and decision-making.	2,3
5	Preparation and analysis of income statement – A case study		Students will gain hands-on experience in preparing an income statement for a real-world case, enhancing their ability to analyse financial performance and make informed business decisions.	2,3
6	Procedural Formalities in Sanction of Farm Loans		Students will understand the step-by-step procedural formalities involved in the sanctioning of farm loans and gain hands-on experience in preparing loan applications and required documentation.	2,3
7	Time Value of Money		Students will gain practical skills in calculating present value, future value, annuities, and discounting cash flows.	2,3
8	Preparation of Bankable projects for various agricultural products and its value-added products		Students will acquire practical skills in preparing bankable project reports for agricultural and value-added products, including financial planning, cost estimation, and feasibility analysis.	2,3,6

TEXT BOOKS:

T1: Subba Reddy, S., Raghu Ram, P. 2018. Agricultural Finance and Management. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

REFERENCE BOOKS:

R1: Subba Reddy, S. Raghu Ram, P., Sastry, T.V.N., and Bhavani Devi, I. 2019. Agricultural Economics. 2nd Edition, Oxford & IBH Publising Co. Pvt. Ltd, New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Introduction to agricultural finance and providing an overview of the importance of finance in agricultural operations covering basic financial concepts and tools relevant to the agricultural sector.	1, 2, 4, 11, 12
2	Gaining knowledge of credit analysis and various institutional and non-institutional sources of agricultural finance.	1, 2, 4, 5, 11, 12
3	Acquiring comprehensive understanding of various types of higher financing institutions along with the functions and services provided by higher financing institutions.	1, 2, 4, 5, 7, 9, 11, 12
4	Understanding the components of financial statements including balance sheet, income statement, their preparation, analysis, and interpretation.	1, 2, 4, 5, 7, 8, 9, 11, 12
5	Acquiring knowledge and skills needed to understand the principles of agricultural cooperation, management practices, and the role of cooperatives in agricultural development in India.	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12

SEMESTER – III									
Course Title	**Fundamentals of Entomology**								
Course Code	**23BSAG2104R**	**Total Credits: 4** **Total Hours: 45T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			3	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. To study the morphology and physiology of different orders of insects 2. To study ecology of various insects, influence of different ecological factors on insect development and distribution. 3. To study about integrated pest management strategies and classification of insecticides.								
CO1	To identify, classify, and manage agricultural pests effectively.								
CO2	To apply Integrated Pest Management (IPM) principles for pest control.								
CO3	To demonstrate proficiency in insect collection, preservation, and sampling techniques.								
CO4	Understand the impact of environmental factors on insect ecology.								
CO5	Analyze the morphology and physiology of insects for effective pest management.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.	**15**	Students will gain understanding on Insect Biology, identify key features of insect anatomy (e.g., exoskeleton, body segments, antennae, wings, and mouthparts), understand the physiological processes that govern insect life, including digestion, respiration, reproduction, and sensory systems. They will also be able to classify insects based on their morphology and life cycle stages (e.g., egg, larva, pupa, adult), understand the life cycle of insects, including metamorphosis (complete vs. incomplete metamorphosis), study insect development and growth patterns, such as molting (ecdysis) and hormonal regulation, explore the mechanisms behind insect adaptation to various environments, including behavioral, physiological, and structural adaptations.	1,2
II	Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance	**5**	Students will understand the ecological roles of insects, learn the basics of the environment, different factors such as biotic and abiotic factors affecting the insect populations, analyse insect-plant interactions, including herbivory and mutualistic relationships like pollination.	1,2,3

			They will also get idea on the study of the importance of insects in food webs and their influence on biodiversity.	
III	Categories of pests. Concept of IPM, Practices, scope and limitations of IPM.	**4**	The students will recognize the different types of insect pests, disease- causing organisms, learn the concept of IPM, its history, advantages, disadvantages and its various scopes. The students will also learn the concept of threshold levels, ETL, EILs and different tools used in IPM that are used to control pests sustainably	2,3
IV	Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, anti-feed ants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.	**11**	The students will learn the definition of insecticide, its classification based on various different categories, hazards of chemical control, its limitations, different provisions of the Insecticide Act, rules and regulations mentioned in the Insecticide Act, Formulations of insecticides, application techniques of insecticides for effective coverage, different symptoms of insecticide poisoning, first aid and antidotes.	1,2
V	Systematics: Taxonomy– importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: 90 91 Report of the ICAR Fifh Deans' Committee Rpor of the ICAR Fifth Deans' Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae,	**10**	The students will learn the basics of insect taxonomy and the classification system (binomial nomenclature), understand key identification features for distinguishing between different insect orders and families, develop skills in using identification keys for identifying insects in the field. They will also get equipped with agriculturally important families of crop pests, beneficial insects etc.	2,3

	Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae			
Practical				
1	Methods of collection and preservation of insects including immature stages	**30**	Students will get acquainted with different methods of insect collection, insect preservation, insect pinning along with their immature stages.	2,3
2	External features of Grasshopper/ Blister beetle;		Students will practically observe the different features of Grasshopper/Blister beetle for acquiring clear picture of their external morphology and anatomy	2,3
3	Types of insect antennae		Students will practically observe different modifications and types of insect antennae	2,3
4	Types of insect mouthparts		Students will practically observe different modifications and types of insect mouthparts	2,3
5	Types of insect legs		Students will practically observe different modifications and types of insect legs	2,3
6	Wing venation, types of wings and wing coupling apparatus.		Students will practically observe different types of insect wings, the different veins, angles and cross veins present in insect wings along with the wing coupling apparatus	,2,3
7	Types of insect larvae and pupae		Students will practically observe different types of insect larvae and pupa	2,3
8	Dissection of digestive system in insects (Grasshopper)		Students will practically dissect the digestive system and observe the different parts of the digestive system.	2,3,5
9 & 10	Dissection of male and female reproductive systems in insects (Grasshopper)		Students will practically dissect the reproductive system and observe the different parts of the male and female reproductive system.	

11, 12, 13 &14	Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance		Students will receive hands on training for identifying insects belonging to different orders, their economic importance and identifying characters.	2,3,6
15 & 16	Insecticides and their formulations		Students will gain insights on different categories of insecticides, their toxicity levels, safety measures, formulations as well as application techniques	1,2
17	Pesticide appliances and their maintenance		Students will gain knowledge of the different types of pesticide appliances (e.g., sprayers, dusters, foggers) and their specific functions in pest control. Students will learn to identify and describe the various parts of pesticide application devices, such as tanks, nozzles, pumps, hoses, and controls. Students will practice the correct methods for operating pesticide application equipment safely and effectively, ensuring that they understand the importance of calibration, pressure adjustments, and flow rates.	2,3
18	Sampling techniques for estimation of insect population and damage		Students will learn about various methods for sampling insect populations in different environments (e.g., random sampling, stratified sampling, or systematic sampling), and the advantages and limitations of each approach. Students will develop the ability to estimate insect population densities using different methods. Students will learn how to assess the level of damage caused by insect pests to crops or other plants, including recognizing feeding damage and understanding how to relate it to pest population densities. Students will understand how sampling data and damage assessments are used to make informed decisions about pest control strategies, such as determining the threshold for action or deciding whether to implement chemical or biological control measures.	2,3

TEXT BOOKS:

T1: Prasad, T.V. 2019. Handbook of Entomology, Fourth Edition, New Vishal Publications, New Delhi

REFERENCE BOOKS:

R1 Chapman, R.F. 2013. The Insects Structure and Function, 5th Edition, Cambridge University Press.

R2 Prasad, T.V. 2019. Handbook of Entomology, Fourth Edition, New Vishal Publications, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N	**Course Outcome**	**Mapped Programme Outcome**
1	To identify, classify, and manage agricultural pests effectively.	1, 2, 4, 5, 6, 10, 12
2	To apply Integrated Pest Management (IPM) principles for pest control.	1, 2, 4, 5, 6, 8, 9
3	To demonstrate proficiency in insect collection, preservation, and sampling techniques.	1, 2, 7
4	Understand the impact of environmental factors on insect ecology.	1, 2, 4, 5, 6, 9, 10, 12
5	Analyse the morphology and physiology of insects for effective pest management.	1, 4, 7

SEMESTER – III									
Course Title	**Agri-Informatics**								
Course Code	**23BSAG2105R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. Understand and apply core concepts in computer systems and software. 2. Explore the role of ICT in agriculture and agricultural decision-making. 3. Analyse and utilize geospatial technology and expert systems in agriculture								
CO1	Gain knowledge of operating systems, their types, and how to efficiently use MS Office tools for document creation, editing, data presentation, statistical analysis, and mathematical computations, specifically applied to agricultural contexts								
CO2	Understand the concepts and types of databases, and how DBMS can be utilized in agriculture for managing, storing, and retrieving agricultural data to improve farm operations and decision-making								
CO3	Explore the use of Information and Communication Technology (ICT) and computer models in agriculture for tasks like calculating crop water and nutrient requirements, automating systems for agri-input management, and supporting decisions through e-agriculture and geospatial technologies								
CO4	Learn how to use smartphone applications and geospatial technologies to access farm advice, market prices, manage postharvest processes, and generate vital agricultural information for informed decision-making								
CO5	Acquire the skills to utilize decision support systems, agriculture expert systems, and soil information systems to support farm planning, optimize crop production, and improve overall farm management practices through IT tools and technologies.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to Computers: Definition, Introduction to Computers, Operating Systems, definition and types	**2**	To be able to identify and explain the key components and types of computers, describe the basic working principles of computing (input, process, output, storage), and understand the definition, functions, and types of operating systems, along with their popular examples such as Windows, Linux, mac OS, and Android	1,2
II	Applications of MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions,	**3**	Students will be able to effectively create and format professional documents in MS Word, design and interpret agricultural data spreadsheets in MS Excel using advanced functions, and present data visually through graphs and statistical analysis, demonstrating an understanding of how to apply mathematical models to real-world agricultural scenarios.	1,2
III	Database, concepts and types, uses of DBMS: Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations	**3**	Upon completion of this module, students will be able to understand the fundamental concepts of databases and Database Management Systems (DBMS), including types of databases (Relational and Non-relational), key DBMS components (such as tables, keys, queries, and relationships), and the applications of DBMS in agricultural data management.	1,2

IV	e-Agriculture concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advisory, e-banking markets market price, postharvest management etc;	**4**	Knowledge of the digital transformation in agriculture through ICT tools like mobile apps, websites, and cloud platforms, enhancing productivity and market access in the agricultural sector. Irrigation management, and pest control, and will demonstrate the ability to use expert systems and soil information systems to optimize farm management and soil health.	2,3
V	Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.	**3**	Upon completion of this course, students will be able to apply Geographic Information Systems (GIS), GPS, and remote sensing technologies to analyse and monitor agricultural conditions, utilizing satellite data for assessing crop health, soil conditions, and climate change impacts. Additionally, students will understand and implement Decision Support Systems (DSS) for agricultural decision-making, such as crop planning.	2,3
			Practical	
1	Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.	**30**	Students will be able to identify and understand key computer components and accessories, demonstrate proficiency in essential DOS commands, compare and contrast different operating systems such as Windows, Unix/Linux, and effectively manage files and folders through creation, organization, and utilization of file management techniques.	2,3
2	Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document		Students will be able to effectively use MS Word for creating and editing scientific documents, including formatting text, inserting references, and organizing content, while also utilizing MS PowerPoint to design and present clear, visually engaging presentations that communicate scientific concepts.	2,3
3	MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data.		By the end of the session, learners will be able to efficiently create and format spreadsheets in MS Excel, apply statistical tools (such as mean, median, standard deviation), write and use mathematical expressions, create various types of graphs, and analyse scientific data to draw meaningful conclusions	2,3

4	MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW)		By the end of this module, students will be able to effectively design and manage an MS Access database for an Agri-information system, including creating and running queries to retrieve relevant data, generating reports for insightful analysis, and demonstrating how the database can be integrated with the World Wide Web (WWW) to enhance data accessibility and information sharing.	2,3,6
5	Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/ Crop Syst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools		Upon completing this module, learners will be able to demonstrate proficiency in using Crop Simulation Models (CSM) such as DSSAT, Crop-Info, Crop Syst, and Wofost to simulate and analyse crop growth. They will also be able to calculate water and nutrient requirements for various crops using CSM and IT tools, integrating their knowledge of programming languages to effectively manipulate data and interpret results for improved crop management and resource optimization.	2,3,6
6	Introduction of Geospatial Technology for generating valuable information for Agriculture		students will be able to apply geospatial technologies, such as GIS (Geographic Information Systems), remote sensing, and GPS, to collect, analyse, and interpret spatial data, enabling the generation of valuable information for improving agricultural practices, enhancing crop management, and optimizing resource use.	2,3,5
7	Hands on Decision Support System. Preparation of contingent crop planning.		Students will be able to use a Decision Support System (DSS) to analyse weather patterns, soil conditions, and market trends to prepare adaptive, contingency crop plans that ensure optimal agricultural productivity under varying environmental and economic conditions.	2,3,5

TEXT BOOKS:

T1: Fatima, F. and Parveen, S. (2023). A Textbook on Agri-Informatics. Kalyani Publishers.

REFERENCE BOOKS:

R1: Gandhi**, N. (2022).** Geo-informatics and Nanotechnology for Precision Farming. LAP Lambert Academic Publishing

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Gain knowledge of operating systems, their types, and how to efficiently use MS Office tools for document creation, editing, data presentation, statistical analysis, and mathematical computations, specifically applied to agricultural contexts	4, 5, 7, 8, 12
2	Understand the concepts and types of databases, and how DBMS can be utilized in agriculture for managing, storing, and retrieving agricultural data to improve farm operations and decision-making	2, 4, 5, 7, 8, 11, 12
3	Explore the use of Information and Communication Technology (ICT) and computer models in agriculture for tasks like calculating crop water and nutrient requirements, automating systems for agri-input management, and supporting decisions through e-agriculture and geospatial technologies	2, 4, 5, 7, 8, 11, 12
4	Learn how to use smartphone applications and geospatial technologies to access farm advice, market prices, manage postharvest processes, and generate vital agricultural information for informed decision-making	2, 4, 5, 7, 8, 12
5	Acquire the skills to utilize decision support systems, agriculture expert systems, and soil information systems to support farm planning, optimize crop production, and improve overall farm management practices through IT tools and technologies.	2, 4, 5, 6, 7, 8, 10, 12

SEMESTER – III									
Course Title	**Farm Machinery and Power**								
Course Code	**23BSAG2106R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. The course offers a comprehensive overview of farm power and machinery, bridging theory with hands-on practice. 2. Students explore IC engine principles, transmission systems, and hydraulic controls, alongside tractor types and implement operation. 3. Through practical sessions, they gain proficiency in maintenance and operation, preparing them to assess and utilize farm machinery effectively in agricultural operations.								
CO1	Understand and apply theoretical knowledge of farm power sources and IC engine principles to analyse engine cycles and system components.								
CO2	Demonstrate practical proficiency in operating and maintaining engine systems, transmission, and hydraulic controls.								
CO3	Evaluate the efficiency and cost-effectiveness of tractor power and implements through hands-on calibration and operation.								
CO4	Apply practical skills in utilizing a variety of farm implements for different agricultural operations, ensuring safety and adherence to standards.								
CO5	Demonstrate competency in tractor driving and operation of power tillers, as well as familiarity with various harvesting and threshing machinery.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Status of Farm power and Mechanization in India, Sources of Energy & its Utilization, Introduction of different engine components of IC engine, Working Principle of IC engine, different engine cycles.	**3**	Study on soil and water conservation, agents of different erosions.	1,2
II	Working Principle of tractor engine, power tiller engine, Introduction to valve timing diagram of tractor engine cylinder, Numerical Approaches.	**3**	Study on various soil erosion control measures, soil loss measurement techniques and their calculation.	2,3,4
III	Comprehensive overview on different Engine system, working principles of tractor fuel supply system, Working of Tractor hydraulic system, Working of Transmission system of tractor engine and their component, Working principle of tractor hydraulic system.	**4**	Study and familiarization with contouring, strip cropping, contour bunds and their design.	2,3
IV	Different methods of Cost analysis of tractor, Cost analysis of tractor and their operations	**2**	Study on mechanics of wind erosion and types of soil movement.	2,3

	with different implements, Numerical Approaches.			
V	Tillage, Primary and secondary tillage, Primary and secondary tillage implements, Different plant protection equipment and their working, Methods of calibration of farm implements	**3**	Study on principles of wind erosion and their control measures and application of wind energy.	2,3
Practical				
1	Introduction of different engine components of IC engine.	**30**	Studying various IC engine components.	2,3
2	To study air cleaning and cooling system of engine.		Study on cleaning and cooling system of tractor engine.	2,3
3	Introduction to different components of transmission systems of tractor engine.		Introduction to transmission system of tractor engine and their components.	2,3
4.	Working Principle of clutch system of tractor engine.		Familiarization with tractor clutch system.	2,3
5.	Working principle of tractor brake system.		Study on tractor brake system.	2,3
6.	Introduction of Hydraulic hitch control system of tractor.		Study on tractor hydraulic system.	2,3
7.	Working of steering mechanism of tractor.		Introduction to tractor steering system.	2,3
8.	Attachment techniques of different farm implement to the tractor/power tiller.		Understand the techniques of implement attachment to tractor or power tiller.	2,3
9.	Maintenance of tractor engine components.		Study about tractor and engine components maintenance.	2,3
10.	Introduction to different types of plant protection equipment and calibration of sprayer.		Study on various sprayer and their calibration method.	2,3
11.	Learning Tractor driving		Familiarization to tractor driving.	1,2,3
12	Familiarization with different types of primary and secondary tillage implement and they're on filed application.		Introduction to various implements used in primary and secondary tillage.	2,3

TEXT BOOKS:

T1: Basavaraj, Srigiri , D. and Jayan, P. R. (2019). A Textbook of Farm Machinery & Power Engineering. New India Publishing Agency- Nipa.

REFERENCE BOOKS:

R1: Mahapatra,J., Mohanty, M.K. and Mishra,A. (2023). Fundamentals and Application of Farm Machinery & Power. Narendra Publishing House

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand and apply theoretical knowledge of farm power sources and IC engine principles to analyse engine cycles and system components.	1, 2, 4, 11, 12
2	Demonstrate practical proficiency in operating and maintaining engine systems, transmission, and hydraulic controls.	1, 2, 4, 5, 11, 12
3	Evaluate the efficiency and cost-effectiveness of tractor power and implements through hands-on calibration and operation.	1, 2, 4, 5, 7, 9, 11, 12
4	Apply practical skills in utilizing a variety of farm implements for different agricultural operations, ensuring safety and adherence to standards.	1, 2, 4, 5, 7, 8, 9, 11, 12
5	Demonstrate competency in tractor driving and operation of power tillers, as well as familiarity with various harvesting and threshing machinery.	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12

SEMESTER – III										
Course Title	**Production Technology for Vegetables and Spices**									
Course Code	**23BSAG2107R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
			1	**0**	**2**	**0**	**0**	**0**	**2**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B.Sc. (Hons.) Agriculture**									
Semester	**Fall/3rd Semester of Second Year of the Programme**									
Course Objectives	1. Comprehensive knowledge of production technologies for major vegetables and spice crops, enabling informed decision-making in cultivation practices. 2. Acquaintance with crop selection, seed technology, cultivation practices, irrigation techniques, disease and pest management, and harvesting methods, with the expertise needed to enhance productivity and quality in vegetable and spice production. 3. Gain practical skills through hands-on training, field visits, and lab exercises, fostering ability to implement sustainable cultivation methods and value addition of the produce									
CO1	Interpretation of the scope and importance of vegetables and spices in human nutrition and national economy									
CO2	Develop practical skills on production techniques of vegetables and spices									
CO3	Understand the disease, pest and physiological disorders adversely affecting yield and quality of vegetables and spice crops, and their management									
CO4	Plan for commercial cultivation of vegetables and spices									
CO5	Analyze skills and requirement of quality enhancement and post-harvest management of vegetables and spice crops, with value addition of those crops.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Importance of vegetables and spices in human nutrition and national economy, development of kitchen gardening	**2**	Understanding the importance of vegetables and spices in human nutrition and the national economy highlights their role in health, income generation, and food security, while promoting kitchen gardening fosters self-sufficiency and sustainable development.	1,2
II	Production technology for cultivation of Tomato, Brinjal, Chilli, Capsicum, Cucurbits, French bean and Pea	**5**	Gain knowledge of advanced production technologies for cultivating Tomato, Brinjal, Chilli, Capsicum, Cucurbits, French bean, and Pea to enhance yield, quality, and sustainability in vegetable farming.	2,3
III	Production technology for cultivation of Cabbage, Cauliflower, Knolkhol and Radish	**3**	Acquire knowledge of the production technology for cultivating vegetable crops like Cabbage, Cauliflower, Knolkhol and Radish, focusing on their agronomic practices,	2,3

			management, and productivity enhancement.	
IV	Production technology for cultivation of Carrot, Beetroot and Potato	**3**	Understand the production technology for cultivating Carrot, Beetroot and Potato, focusing on their agronomic practices, management techniques, and strategies to enhance yield and quality.	2,3
V	Production technology for cultivation of Spinach, Onion, Garlic and Coriander	**2**	Learn about the production technology specific to Spinach, Onion, Garlic and Coriander cultivation, along with effective cultivation methods, crop regulation measures and plans for managing pests and diseases, to optimize its quality, productivity, and profitability	2,3
Practical				
1	Identification of important vegetables	**30**	Develop skills in identifying important vegetables and spice crops, preparing nursery beds, transplanting seedlings, applying fertilizers, extracting vegetable seeds, and understanding the economic aspects of vegetable and spice cultivation for improved productivity and profitability.	1,2
2	Identification of spice crops and their seeds			1,2
3	Preparation of nursery beds for raising healthy vegetable seedlings			2,3
4.	Transplanting of vegetable seedlings			2,3
5.	Fertilizer application for various vegetable crops			2,3
6.	Study of methods of vegetable seed extraction			2,3
7.	Study of Economics of vegetables and spice cultivation			2,3,4

TEXT BOOKS:

T1: Pradhan, S. 2014 Vegetable Crops of India, Biotech publication.

REFERENCE BOOKS:

R1: Muthukumar, P., Selvakumar, R. 1957. Glaustas Horticulture, New Vishal Publication.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Interpretation of the scope and importance of vegetables and spices in human nutrition and national economy	1, 2, 4, 6, 7, 8, 11
2	Develop practical skills on production techniques of vegetables and spices	1, 2, 4, 6, 7, 8, 11
3	Understand the disease, pest and physiological disorders adversely affecting yield and quality of vegetables and spice crops, and their management	1, 2, 4, 6, 7, 8, 11
4	Plan for commercial cultivation of vegetables and spices	1, 2, 4, 5, 6, 7, 8, 11
5	Analyse skills and requirement of quality enhancement and post-harvest management of vegetables and spice crops, with value addition of those crops.	1, 2, 4, 5, 6, 7, 8, 11

SEMESTER – III									
Course Title	**Environmental Studies and Disaster Management**								
Course Code	**23BSAG2108R**	**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**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. Explore the concept of the environment, its importance, scope, and multidisciplinary nature and study various natural resources such as water, forests, land, energy, and food. 2. Understand the concept, structure, and functions of ecosystems and understand biodiversity conservation methods. 3. Examine different types of pollution, their causes, and their impact on the environment and potential remedies.								
CO1	Understand the interdisciplinary nature and significance of environmental studies.								
CO2	Analyse the utilization, impact, and sustainable management of natural resources.								
CO3	Evaluate biodiversity conservation measures and threats to ecosystems.								
CO4	Assess environmental pollution causes, effects and mitigation strategies.								
CO5	Apply theoretical knowledge to practical scenarios, including fieldwork and disaster management, for comprehensive understanding and solutions.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Multidisciplinary nature of environmental studies- Definition, scope and importance. Natural resources- Renewable and non-renewable resources and their associated problems. Forest resources- Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forest and tribal people. Water resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources- Use and exploitation, environmental effects of extracting and using mineral resources. Food resources- World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, and salinity. Energy resources-Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. 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.	**6**	Understand the importance of environmental studies, the challenges of resource exploitation, and sustainable practices for resource conservation and equitable use.	1,2

II	Ecosystems- Concept, 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 forest, grassland, desert and aquatic ecosystems. Biodiversity and its conservation- Introduction, definition, genetic, species, ecosystem diversity and biogeographical 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, endangered and endemic species of India. In-situ and Ex-situ conservation of biodiversity.	**6**	Understand ecosystem structure, functions, energy flow, ecological interactions, and biodiversity, including its value, threats, and conservation methods, with a focus on India's rich diversity.	1,2
III	Environmental pollution- Definition, cause, effects and control measures of air, water, soil, marine, noise and thermal pollution and nuclear hazards. Solid waste management- Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social issues and the environment- Unsustainable to sustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management.	**7**	Understand environmental pollution, sustainable practices, emphasizing prevention, mitigation, and the role of individuals and organizations in addressing these challenges.	1,2
IV	Environmental ethics- Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment protection acts, 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, variation among nations, population explosion. Role of Information Technology in environment and human health	**5**	Understanding environmental ethics, major ecological issues, protection laws, population impact, and the role of IT helps in promoting sustainability and addressing global environmental challenges.	1,2
V	Natural disasters- Meaning and nature, types (floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, global warming, sea level rise, ozone depletion) and effects. Man-made disasters- Nuclear, chemical, and biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents,	**6**	Gain knowledge of natural and man-made disasters, their effects, and disaster management strategies, focusing on response frameworks, roles of organizations, and disaster relief efforts.	1,2

	sea accidents. Disaster management- International strategy for disaster reduction at national and global levels; National disaster management framework- Financial arrangements, role of NGOs, community–based organizations and media, central, state, district and local administration, armed forces in disaster response, police and other organizations. Feeding the people struck by the disaster, managing house and dress need during disaster.			
Practical				
1	Visit to a local area to document environmental assets river/ forest/ grass land/ hill /mountain	**30**	Document and analyse the key environmental assets of a local area, understand their ecological significance, and propose strategies for their conservation.	2,3
2	Visit to a local polluted site- Urban/rural/industrial/agricultural.		Identify sources and impacts of pollution at a local site, analyse its effects on the environment and community, and recommend practical solutions for mitigation and sustainable management.	2,3
3	Study of common plants, insects, birds and study of simple ecosystems i.e. pond, river, hill slopes, etc.		Identify and classify common plants, insects, and birds, analyse their roles in simple ecosystems, and explain the interdependence of biotic and abiotic components in ecosystems like ponds, rivers, and hill slopes.	1,2,3

TEXT BOOKS:

T1: Nakkella, A.K. 2022. A Text Book of Environmental Science. Bharti Publications.

REFERENCE BOOKS:

R1: Singh, Y.K. 2022. Environmental Science. New Age International Private Limited.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the interdisciplinary nature and significance of environmental studies.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Analyse the utilization, impact, and sustainable management of natural resources.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Evaluate biodiversity conservation measures and threats to ecosystems.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Assess environmental pollution causes, effects and mitigation strategies.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Apply theoretical knowledge to practical scenarios, including fieldwork and disaster management, for comprehensive understanding and solutions.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – III									
Course Title	**Communication Skills and Personality Development**								
Course Code	**23BSAG2109R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/3rd Semester of Second Year of the Programme**								
Course Objectives	1. Develop both verbal and nonverbal communication skills, which encompasses effective listening, precise writing, and confident public speaking, to improve their overall ability to convey ideas clearly and persuasively in both personal and professional contexts 2. Cultivate the skills needed for collaborative teamwork, leadership, and organizational abilities, hence preparing students to handle various professional scenarios. 3. Impart students with advanced academic skills, including comprehensive reading, precise note-taking, and systematic documentation practices, ensuring they can produce well-structured academic and technical documents, conduct effective research, and present their findings.								
CO1	Demonstrate understanding of personality development and apply effective communication skills to enhance interpersonal interactions.								
CO2	Document observations systematically, apply proper citation practices, and produce technically accurate written work.								
CO3	Analyse technical texts, evaluate content critically, and create concise summaries and abstracts.								
CO4	Deliver structured presentations and impromptu speeches effectively to engage diverse audiences.								
CO5	Collaborate in teams, apply leadership skills, and organize group discussions, seminars, or conferences efficiently.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Concept of Personality and Personality Development, Meaning and process of communication, Verbal and nonverbal communication, Listening and note-taking	**3**	Demonstrate understanding of personality development and apply effective communication skills to enhance interpersonal interactions.	1,2
II	Writing skills, Field diary and lab record, Indexing, footnote, and bibliographic procedures	**3**	Document observations systematically, apply proper citation practices, and produce technically accurate written work.	1,2,3
III	Reading and comprehension of general and technical articles, Precise writing, Summarizing and abstracting.	**3**	Analyse technical texts, evaluate content critically, and create concise summaries and abstracts.	1,2
IV	Oral presentation skills, Public speaking, Impromptu presentation, Individual and group presentation.	**3**	Deliver structured presentations and impromptu speeches effectively to engage diverse audiences.	2,3

V	Group discussion, Organizing seminars and conferences, Leadership and coordination in group settings	**3**	Collaborate in teams, apply leadership skills, and organize group discussions, seminars, or conferences efficiently.	2,3
Practical				
1	Listening Skill	**30**	Develop active listening skills by accurately receiving, interpreting, and responding to verbal and non-verbal cues in various communication contexts.	2,3
2	Note Taking Skill		Develop the ability to effectively organize, summarize, and synthesize information using structured note-taking techniques for improved comprehension and retention.	2,3
3	Writing Skill		Develop clear, coherent, and well-structured written communication skills by applying appropriate writing techniques and critical thinking.	2,3
4	Oral Presentation Skill		Demonstrate effective oral presentation skills by organizing content logically, delivering with clarity and confidence, and engaging the audience appropriately.	2,3
5	Field Diary and Lab Record		Students will accurately document observations, analyze experimental data, and synthesize findings in a structured field diary and lab record, demonstrating critical thinking and scientific communication skills.	2,3,4
6	Indexing, Footnote and Bibliography		Demonstrate the ability to create accurate indexes, footnotes, and bibliographies using appropriate formatting standards to enhance document organization and citation integrity.	2,3
7	Reading and Comprehension Skill		Develop the ability to analyze, interpret, and evaluate texts critically to enhance reading comprehension and inferential reasoning.	2,3,5
8	Precise writing Skills		Develop the ability to write clear, concise, and precise texts by applying effective writing techniques and critical thinking skills.	2,3
9	Summarising and Abstracting skills		Apply summarizing and abstracting techniques to analyze and condense information effectively, demonstrating comprehension and critical thinking skills.	2,3

10	Individual and Group Presentation Skills		Demonstrate effective verbal and non-verbal communication skills in individual and group presentations by applying structured content delivery, audience engagement techniques, and professional presentation tools.	2,3

TEXT BOOKS:

T1: Andersen, P.A. 2008. Nonverbal Communication: Forms and Functions. Waveland Press

T2: Lucas, S.E. 2019. The Art of Public Speaking. Mc-Graw-Hill

REFERENCE BOOKS:

R1: Mitra, B.K. 2016. Personality Development and Soft Skills. Oxford University

R3: Indian Council of Agricultural Research 2020. Handbook of Agricultural Extension.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Demonstrate understanding of personality development and apply effective communication skills to enhance interpersonal interactions.	3, 5, 10, 11
2	Document observations systematically, apply proper citation practices, and produce technically accurate written work.	3, 5, 7, 11
3	Analyse technical texts, evaluate content critically, and create concise summaries and abstracts.	3, 5, 11
4	Deliver structured presentations and impromptu speeches effectively to engage diverse audiences.	3, 5, 10, 11
5	Collaborate in teams, apply leadership skills, and organize group discussions, seminars, or conferences efficiently.	3, 5, 10, 11

SEMESTER – III									
Course Title	**English Language for Excellence**								
Course Code	**23UBPD212R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall / 3rd Semester of Second Year of the programme**								
Course Objectives	1. Enable students to revise their grammar and strengthening their vocabulary helping them writing and speaking. 2. Enhance their non-verbal communicative skills. 3. Introduce them with the etiquette and skills required for appearing in an interview and the concept of market, trend and growing competition.								
CO1	Enable to develop the skills of self-management skills along with recent market								
CO2	Enable to implement sentence construction rules to produce clear and concise written and spoken expressions.								
CO3	Enable to participate in a group discussion.								
CO4	Develop an understanding of non-verbal communication intricacies and identify and overcome potential barriers to effective communication. Understand the impact of nonverbal cues such as body language, facial expressions, and gestures on communication								
CO5	Understand the recent market situation.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
	Practical			
1	**Ice-breaking session,** **Know your partner.** Basics of communication	**5**	Develop active listening skills by accurately receiving, interpreting, and responding to verbal and non-verbal cues in various communication contexts.	1,2,3
2	**Non-verbal Communication Skills:** • Introduction to non-verbal communication • Body Language • Types of body language **Blood relation** • Concept of relational hierarchy ii. Expression based problem discussion	**5**	Develop the ability to effectively organize, summarize, and synthesize information using structured note-taking techniques for improved comprehension and retention.	1,2,3
3	Science of body language Importance and Impact of Body Language	**5**	Develop clear, coherent, and well-structured written communication skills by applying appropriate writing techniques and critical thinking.	1,2,3

4	**Writing Skills** ▪ The basics of writing ▪ Avoid ambiguity and vagueness • Paragraph Writing (Practice Session) **SI and CI and Profit & Loss** Concepts, Formula with short tricks, Successive discount, GST Application of different patterns problem	**5**	Demonstrate effective oral presentation skills by organizing content logically, delivering with clarity and confidence, and engaging the audience appropriately.	1, 2, 3, 6
5	• Letter Writing • Resume and cover letter	**5**	Students will accurately document observations, analyse experimental data, and synthesize findings in a structured field diary and lab record, demonstrating critical thinking and scientific communication skills.	1, 2, 3, 6
6	**Grammar** Prepositions, correct usage of preposition. Simple and Complex sentence **Time, Work and Speed distance** • Short tricks On Time and work, Pipe and cistern, speed distance • Problem discussion and exercise	**5**	Demonstrate the ability to create accurate indexes, footnotes, and bibliographies using appropriate formatting standards to enhance document organization and citation integrity.	1,2,6
7	Grammar • Compound ▪ Active and passive voice (Exercise or practice sheets to be given)	**5**	Develop the ability to analyse, interpret, and evaluate texts critically to enhance reading comprehension and inferential reasoning.	1, 2, 4, 6
8	▪ Planning and Elements of group discussion. ▪ Effectively disagreeing, • Summarizing and attaining the objective.	**5**	Develop the ability to write clear, concise, and precise texts by applying effective writing techniques and critical thinking skills.	1,2,6
9	Activity **Syllogism with statement conclusion** • Concepts of Venn diagram • Relational strategy • Analysis strategy to solve statement based problem	**5**	Apply summarizing and abstracting techniques to analyse and condense information effectively, demonstrating comprehension and critical thinking skills.	1, 2, 3, 6
10	Personal Interview (concept and practice) Common interview, question and answering strategies.	**5**	Demonstrate effective verbal and non-verbal communication skills in individual and group presentations by applying structured content delivery, audience engagement techniques, and professional presentation tools.	1,2,3

11	Telephone Interview Etiquettes Introduction to Dress code and grooming **Order ranking and Direction Sense** ▪ Concepts of maps, cardinal direction ▪ Pythagoras theorem and Formula • short tricks to solve problems	**5**	Learn the skills that are required to face interview and understand the basics of grooming.	1,2,3
12	Self-management skills ▪ SWOT analysis ▪ self-regulation • personal hygiene	**5**	Enhance the understanding of market position and industry trends. Recognition of areas of growth and development.	1,2,3

TEXT BOOKS:

T1: Barrett, Grant.2016.Perfect *English Grammar: The Indispensible Guide to Excellent Writing and Speaking*, ZephyrosPress.

T2: Wren,P.C and Martin,H. 1995. *High School English Grammar and Composition*, S Chand Publishing.

T3: McDowell, Gayle Laakmann.2008.*Cracking the Coding Interview* (Indian Edition)

T4: Adil Amin Tak, Mohammad Aslam *2008: Introduction to English Phonology and Phonetics*

REFERENCE BOOKS:

R1: Zinsser,William.(2006) *On Writing Well: The Classic Guide to Writing Nonfiction*, Harper Perennial.

R2: Murphy, Raymond,.(2012) *English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English*, Cambridge University Press

R3: Taylor, J. and Wright, J. *IELTS Advantage Reading Skills: A step-by step guide to a high IELTS reading score*, Delta Publishing by Klett.

OTHER LEARNING RESOURCES:

https://learning.shine.com/talenteconomy/career-help/top-group-discussion-skills/https://www.coursera.org/articles/conflict-management.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMOUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome(CO)**	**Mapped Program Outcome**
1	Enable to develop the skills of self-management skills along with recent market	3, 5
2	Enable to implement sentence construction rules to produce clear and concise written and spoken expressions.	3, 5
3	Enable to participate in a group discussion.	3, 5
4	Develop an understanding of non-verbal communication intricacies and identify and overcome potential barriers to effective communication. Understand the impact of nonverbal cues such as body language, facial expressions, and gestures on communication	3, 5
5	Understand the recent market situation.	3, 5

SEMESTER – IV									
Course Title	**Statistical Methods**								
Course Code	**23BSAG2201R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. Understand basic statistical concepts and their applications in agriculture. 2. Apply statistical methods to analyse and interpret agricultural data. 3. Apply statistical techniques to summarize, analyse, and interpret agricultural data.								
CO1	Apply statistical methods to agricultural data for analysis and decision-making								
CO2	Utilize probability theory to solve agricultural problems effectively								
CO3	Evaluate relationships among agricultural variables using correlation and regression analysis								
CO4	Perform statistical tests to assess significance and make inferences from agricultural data								
CO5	Design and execute efficient agricultural studies using appropriate sampling methods and variance analysis techniques								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion	**3**	Understand the basics of statistics, its role in agriculture, how to visually represent data, and summarize it using measures of central tendency and dispersion.	1,2
II	Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability.	**3**	Learn the concept of probability, apply the addition and multiplication theorems, and solve basic probability problems.	1,2
III	Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram Karl Pearson's Coefficient of Correlation. Linear Regression Equations.	**3**	Understand binomial and Poisson distributions, the concept of correlation, scatter diagrams, Karl Pearson's correlation coefficient, and linear regression equations for data analysis.	1,2
IV	Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification	**3**	Learn the basics of tests of significance, apply t-tests for one and two samples, perform Chi-square tests for independence, and understand analysis of variance (ANOVA) with one-way classification.	1,2,3
V	Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample	**3**	Understand different sampling methods, distinguish between sampling and complete enumeration, and learn to perform simple random sampling with and without replacement using random number tables.	1,2,3

Practical				
1	Graphical Representation of Data.	**30**	Learn how to represent data visually using various graphical methods such as bar charts, histograms, pie charts, and line graphs to enhance data interpretation and analysis.	1,2
2	Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles.		Understand and calculate measures of central tendency (mean, median, and mode) for ungrouped data, along with quartiles, deciles, and percentiles to summarize and interpret data distribution.	2,3,4
3	Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles.		Learn to calculate measures of central tendency (mean, median, and mode) for grouped data, along with quartiles, deciles, and percentiles to analyse data distribution effectively.	2,3,4
4.	Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data).		Understand and calculate measures of dispersion (range, variance, and standard deviation) for both ungrouped and grouped data to assess the spread and variability of the data.	2,3,4
5	Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data).		Learn to calculate moments, measures of skewness, and kurtosis for both ungrouped and grouped data to analyse the asymmetry and peakedness of data distributions.	2,3,4
6	Correlation & Regression Analysis		Understand the concepts of correlation and regression analysis to examine the relationship between variables and make predictions based on data.	1,2,3
7	Application of One Sample t-test Application of Two Sample Fisher's t-test		Learn the application of the one-sample t-test to compare a sample mean with a population mean, and the two-sample Fisher's t-test to compare the means of two independent samples.	2,3
8	Chi-Square test of Goodness of Fit Chi-Square test of Independence of Attributes for 2 ×2 contingency table		Understand the Chi-square test of goodness of fit to assess how well observed data fits expected distributions, and the Chi-square test of independence to determine the relationship between two categorical variables in a 2×2 contingency table.	2,3
9	Analysis of Variance One Way Classification Analysis of Variance Two Way Classification		Learn the analysis of variance (ANOVA) for one-way classification to compare means across multiple groups, and for two-way classification to analyse the interaction between two factors affecting the data.	2,3

10	Selection of random sample using Simple Random Sampling.		Learn how to select a random sample using simple random sampling methods, ensuring each member of the population has an equal chance of being selected.	2,3

TEXT BOOKS:

T1: Rangaswamy, R. (2022).A Textbook of Agricultural Statistics. New Age International Private Limited

REFERENCE BOOKS:

R1: Amdekar, S.J. (2013). Statistical Methods: For Agricultural and Biological Sciences. Narosa Publishing House

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Gain knowledge of operating systems, their types, and how to efficiently use MS Office tools for document creation, editing, data presentation, statistical analysis, and mathematical computations, specifically applied to agricultural contexts	1, 2, 4, 7, 8, 12
2	Understand the concepts and types of databases, and how DBMS can be utilized in agriculture for managing, storing, and retrieving agricultural data to improve farm operations and decision-making	1, 2, 4, 7, 8, 12
3	Explore the use of Information and Communication Technology (ICT) and computer models in agriculture for tasks like calculating crop water and nutrient requirements, automating systems for agri-input management, and supporting decisions through e-agriculture and geospatial technologies	1, 2, 4, 7, 8, 11, 12
4	Learn how to use smartphone applications and geospatial technologies to access farm advice, market prices, manage postharvest processes, and generate vital agricultural information for informed decision-making	1, 2, 3, 4, 7, 8, 9, 12
5	Acquire the skills to utilize decision support systems, agriculture expert systems, and soil information systems to support farm planning, optimize crop production, and improve overall farm management practices through IT tools and technologies.	1, 2, 4, 7, 8, 9, 12

SEMESTER – IV									
Course Title	**Production Technology for Ornamental Crops, MAP and Landscaping**								
Course Code	**23BSAG2202R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. Understand the importance, scope, and production technology of ornamental, medicinal, and aromatic plants. 2. Develop skills in plant identification, cultivation, maintenance, and post-harvest handling. 3. Learn processing, value addition, and commercial aspects of ornamental and medicinal plants.								
CO1	Demonstrate proficiency in identifying ornamental, medicinal, and aromatic plants, understanding their importance, scope, and landscape uses								
CO2	Apply principles of landscaping to design and plan outdoor spaces effectively, utilizing trees, shrubs, and climbers for aesthetic and functional purposes								
CO3	Implement production technologies for important flower crops and medicinal plants under open conditions, including cultivation, irrigation, and pest management								
CO4	Execute package of practices for the cultivation of loose flowers, incorporating methods for optimal growth and post-harvest handling to maintain quality								
CO5	Apply processing and value addition techniques to ornamental crops and MAPs produce, enhancing their marketability and economic value in the horticultural industry								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping; Principles of landscaping	**2**	Understanding the importance and scope of ornamental crops, medicinal and aromatic plants and landscaping; Principles of landscaping	1,2
II	Landscape uses of trees, shrubs and climbers. Production technology for cultivation of Rose, Gladiolus, Chrysanthemum, Orchid	**5**	Gain knowledge of uses of trees, shrubs and climbers; advanced production technologies for cultivating Rose, Gladiolus, Chrysanthemum, Orchid to enhance yield and quality	2,3
III	Production technology for cultivation of Marigold, Jasmine, Gaillardia, Crossandra	**3**	Acquire knowledge of the production technology for cultivating Marigold, Jasmine, Gaillardia, Crossandra, focusing on their agronomic practices, management, and productivity enhancement.	2,3
IV	Production technology for cultivation of Ashwagandha, Isabgol, Sarpagandha, Aloe vera, Periwinkle, Mint, Lemon grass, Citronella, ocimum, Gerenium, Vetiver	**3**	Understand the production technology for cultivating Ashwagandha, Isabgol, Sarpagandha, Aloe vera, Periwinkle, Mint, Lemon grass, Citronella, ocimum, Gerenium, Vetiver, focusing on their agronomic practices, management	2,3

			techniques, and strategies to enhance yield and quality.	
V	Processing and value addition in ornamental crops and MAPs produce.	**2**	Learn about the processing and value addition in ornamental crops and MAPs produce	2,3
Practical				
1	Identification of Ornamental plants. Seasonal annuals	**30**	Gain practical skills in identifying ornamental, medicinal, and aromatic plants, designing and maintaining gardens, implementing cultivation and intercultural practices, performing pruning and post-harvest handling, processing medicinal and aromatic plants, and understanding commercial flower and MAP production.	1,2,3,6
2	Identification of Medicinal and Aromatic Plants			
3	Garden Adornments & features			
4.	Training and pruning of Ornamental plants			
5.	Planning and layout of garden			
6.	Special Practices of Ornamental plants			
7.	Intercultural operations in flowers and MAP.			
8.	Harvesting and post-harvest handling of cut and loose flowers			
9.	Processing of MAP			
10.	Visit to commercial flower/MAP unit			

TEXT BOOKS:

T1: Raj, D. 2017. Floriculture at a Glance, Kalyani Publishers, Ludhiana.
T2: Bhattacharjee, S.K. De, L.C. 2010. Advanced Commercial Floriculture 2 Vols, Aavishkar Publishers & Distributors.
T3: Salaria, A.A., Salaria, B.S. A2Z 2013. Horticulture at a Glance Vol-3. India Research Press.

REFERENCE BOOKS:

R1: Somani, L.L. 2010 Floriculture & Landscaping at a Glance, Agrotech Publishing Academy.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Demonstrate proficiency in identifying ornamental, medicinal, and aromatic plants, understanding their importance, scope, and landscape uses.	1, 2, 4, 5, 6, 8, 11
2	Apply principles of landscaping to design and plan outdoor spaces effectively, utilizing trees, shrubs, and climbers for aesthetic and functional purposes	1, 2, 4, 5, 6, 7, 8, 11
3	Implement production technologies for important flower crops and medicinal plants under open conditions, including cultivation, irrigation, and pest management.	1, 2, 4, 5, 6, 7, 8, 11
4	Execute package of practices for the cultivation of loose flowers, incorporating methods for optimal growth and post-harvest handling to maintain quality.	1, 2, 4, 5, 6, 7, 8, 11
5	Apply processing and value addition techniques to ornamental crops and MAPs produce, enhancing their marketability and economic value in the horticultural industry.	1, 2, 4, 5, 6, 7, 8, 11

SEMESTER – IV									
Course Title	**Renewable Energy and Green Technology**								
Course Code	**23BSAG2203R**	**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	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. Understand the working principle and working of various appliances based on renewable energy sources 2. Carry out the task of operation and maintenance of biogas plant, gasifier, solar water heater solar cooker etc. 3. Apply the working principle of renewable energy for development of appropriate technologies								
CO1	Comprehend diverse energy sources' roles in agriculture, emphasizing biomass, biogas, and solar energy.								
CO2	Apply biofuel production knowledge for sustainable agricultural energy solutions.								
CO3	Utilize solar technologies effectively in agricultural processes like cooking, drying, and water heating.								
CO4	Analyze the application of wind energy systems in agriculture.								
CO5	Gain hands-on experience with renewable energy gadgets and processes for agricultural sustainability.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Status of Farm power and Mechanization in India, Sources of Energy, Classification of energy sources, Introduction of conventional and non-conventional sources of energy, Familiarization with biomass	**4**	Study on fundamental concept of renewable energy and its types, different types of bio-mass.	1,2
II	Different methods used in biofuel production, Biomass utilization for biofuel production and their application.	**2**	Study on production of biofuel and their application.	2,3
III	Familiarization with types of biogas plants and gasifiers and their utilization as bioenergy resource.	**2**	Study and familiarization with different types of biogas plant and gasifiers.	2,3
IV	Introduction of solar energy, collection and their application, Familiarization with solar cooker, solar water heater, Application of solar energy: solar drying, solar pond.	**4**	Study on solar energy and their application and working of different5 solar energy gadgets.	2,3
V	Introduction to solar distillation system and their application, Introduction to solar photovoltaic system and their application, Introduction of wind energy and their application	**3**	Study on different types of distillation unit, solar photovoltaic system and wind energy	2,3

Practical				
1	Introduction of different components of gasifier.	**30**	Study on various components of gasifier and their working.	2,3
2	Introduction to solar thermal devices; Solar cooker.		To Study on solar cookers and their working.	2,3
3	Introduction to solar thermal devices dryer, still, solar pond.		To Study on solar dryer and solar pond.	2,3
4.	Design and working of water heater, solar green house.		To study on working of water heater and solar green house.	2,3
5.	Characterization of biomass; Proximate and Ultimate.		Analysis of biomass, determination of carbon content, moisture content, ash content, volatility of biomass.	2,3,4
6.	Calorific value estimation of biomass.		Determination of calorific value of different biomass resources.	2,3
7.	Introduction to Biogas and producer gas.		To study about biogas and producer gas and also their production.	2,3
8.	Design and benefit analysis of community biogas plant.		Understand the design and numerical on biogas plant.	2,3
9.	Study on Solar Photovoltaic cell characteristics.		Study about sola photovoltaic cell and their uses.	2,3

TEXT BOOKS:

T1: Culp, A.W. 1991. Principles of Energy Conversion, McGraw Hill Pub. Co Inc.
T2: Rai, G.D. 2001. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

REFERENCE BOOKS:

R1: Odum. H.T. and Odum, E.C. 1976. Energy Basis for Man and Nature. McGraw, Hill Pub. Co. Inc.
R2: Garg, H.P. and Prakash J. 1976. Solar Energy- Fundamentals and Applications. Tata McGraw, Hill Pub. Co. Inc.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Comprehend diverse energy sources' roles in agriculture, emphasizing biomass, biogas, and solar energy.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
2	Apply biofuel production knowledge for sustainable agricultural energy solutions.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
3	Utilize solar technologies effectively in agricultural processes like cooking, drying, and water heating.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
4	Analyse the application of wind energy systems in agriculture.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
5	Gain hands-on experience with renewable energy gadgets and processes for agricultural sustainability.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12

SEMESTER – IV									
Course Title	**Problematic Soil and Their Management**								
Course Code	**23BSAG2204R**	**Total Credits: 2** **Total Hours: 30T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. Learn about soil quality and health. 2. Familiarize with the distribution of wastelands and problem soils in India 3. Use of GIS in soil survey and learn land capability and suitability classifications.								
CO1	Understand the concept of soil quality and health, distribution of waste land and problem soils over India								
CO2	Apply remote sensing and GIS to identify problem soils followed by the reclamation and management strategies of the problem soils								
CO3	Gain knowledge of quality and standards of irrigation water and its use in agriculture								
CO4	Identify multipurpose tree species and their uses in bioremediation								
CO5	Understand land classification into the capability and suitability classes and subclasses								

Unit-No.	**Content**	**Contact Hours**	**Learning Outcome**	**KL**
I	Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties.	**6**	Understand soil quality and health, and identify the distribution and categorization of waste land and problem soils in India based on their properties.	1,2
II	Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils	**6**	Understand the reclamation and management techniques for various problematic soils, including saline, sodic, acid, acid sulfate, eroded, compacted, flooded, and polluted soils.	1,2
III	Remote sensing and GIS in diagnosis and management of problem soils.	**2**	Learn the use of remote sensing and GIS in diagnosing and managing problem soils.	2,3
IV	Irrigation water – quality and standards, utilization of saline water in agriculture.	**6**	Understand irrigation water quality, standards, and the use of saline water in agriculture.	2,3
V	Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems	**10**	Understand the role of multipurpose tree species in bioremediation, land capability and suitability classification, and the challenges posed by problematic soils in different agro-ecosystems.	2,3

TEXT BOOKS:

T1: Das, D.K., (2020). Problematic Soils and Their Management. Kalyani Publishers.

REFERENCE BOOKS:

R1: Mailappa, A.S. (2023). Management of Problematic Soils and Water. Brillion Publishing

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the concept of soil quality and health, distribution of waste land and problem soils over India	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Apply remote sensing and GIS to identify problem soils followed by the reclamation and management strategies of the problem soils	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Gain knowledge of quality and standards of irrigation water and its use in agriculture	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Identify multipurpose tree species and their uses in bioremediation	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Understand land classification into the capability and suitability classes and subclasses	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – IV									
Course Title	**Introductory Agro Meteorology & Climate Change**								
Course Code	**23BSAG2205R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. Understanding Agricultural Meteorology and Atmospheric Phenomena 2. Exploring Weather Patterns and Climate Dynamics 3. Assessing Climate Change and Its Impacts on Agriculture								
CO1	Gain a comprehensive understanding of agricultural meteorology, including its scope and significance in agricultural production. They will be able to analyse and interpret meteorological data to support informed decisions in crop and livestock management.								
CO2	Develop a detailed understanding of the Earth's atmosphere, its composition, structure, and the atmospheric weather variables such as temperature, humidity, pressure, and wind. They will be able to explain how these factors influence agriculture and weather patterns								
CO3	Acquire the skills to identify and interpret weather phenomena such as cyclones, monsoons, precipitation, and extreme weather events like heat waves and floods. They will also learn to assess their impact on agricultural systems and understand the mechanisms behind these weather events								
CO4	Understanding of climate change, its causes, and the potential impacts on global and regional agriculture. They will learn how climatic variability and global warming can alter agricultural productivity and how to adapt agricultural practices to these changes								
CO5	Learn about different types of weather forecasting, their methodologies, and how these forecasts are used in agricultural planning. They will also study the process of weather forecasting for mitigating agricultural risks and optimizing production cycles								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Agricultural Meteorology and the Atmosphere-Meaning and Scope of Agricultural Meteorology: Definition, importance in agriculture, and the role of meteorological factors in crop production. Earth's Atmosphere: Composition, extent, and structure of the atmosphere. Atmospheric Weather Variables: Basic elements of weather – temperature, humidity, wind, pressure, and precipitation.	**2**	By the end of this module, students will be able to analyse different types of weather forecasts and their applications in agricultural planning, assess the causes and effects of climate change and global warming, and evaluate their impacts on regional and national agricultural systems, proposing strategies for mitigation and adaptation.	1,2
II	Atmospheric Properties and Radiation-Atmospheric Pressure: Variation with height. Wind: Types of wind, daily and seasonal variations of wind speed, cyclones, anticyclones, land breeze, and sea breeze. Nature and Properties of Solar Radiation: Solar constant, shortwave and long wave radiation,	**3**	"Students will be able to explain the variation of atmospheric pressure with height, describe different types of winds including their daily and seasonal variations, and analyze the nature and properties of solar radiation, including solar constant, radiation	1,2

	depletion of solar radiation, thermal radiation.Net radiation and albedo		types, and the concepts of net radiation and albedo."	
III	Temperature, Humidity, and Precipitation-Atmospheric Temperature: Temperature inversion, lapse rate, daily and seasonal variations, vertical profile of temperature. Energy balance of Earth. Atmospheric Humidity: Concept of saturation, vapour pressure, condensation process. Formation of dew, fog, mist, frost, and clouds. Precipitation: Types (rain, snow, sleet, hail) and the process of precipitation. Cloud formation and classification. Artificial rainmaking techniques.	**4**	Students will be able to explain the key concepts of atmospheric temperature, humidity, and precipitation, including temperature inversion, lapse rate, energy balance of Earth, the condensation process, cloud formation, and the types and processes of precipitation, as well as discuss the impact and techniques of artificial rainmaking	1,2
IV	Weather Hazards, Monsoon, and Agricultural Impacts- Monsoon: Mechanism, importance in Indian agriculture, and its seasonal influence on crops. Weather Hazards: Drought, floods, frost, tropical cyclones, heat waves, and cold waves. Agriculture and Weather Relations: Modifications of crop microclimates. Climatic normal for crop and livestock production.	**3**	Critically analyse the mechanisms and seasonal influences of the monsoon on Indian agriculture, identify and assess various weather hazards (such as droughts, floods, and heat waves), and understand their impact on crop and livestock production. Additionally, students will be able to explore how weather conditions modify crop microclimates and interpret climatic normal to optimize agricultural practices.	2,3,4
V	Weather Forecasting, Climate Change, and Impacts on Agriculture. Weather Forecasting: Types of weather forecasts and their uses in agricultural planning. Climate Change and Climatic Variability: Causes of climate change, global warming. Impact of climate change on regional and national agriculture.	**3**	able to analyse the various types of weather forecasts and their applications in agricultural planning, assess the causes and effects of climate change, and evaluate its impact on regional and national agricultural systems, proposing strategies to mitigate its effects on crop production and food security.	2,3,4
Practical				
1	Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording	**30**	Students will be able to demonstrate an understanding of the principles and methods involved in the establishment of an Agrometeorological Observatory, including the selection of appropriate sites for instrument placement, exposure conditions for accurate data recording, and the process of monitoring and interpreting weather data relevant to agricultural practices. This outcome emphasizes both theoretical knowledge and	2,3

			practical application related to the observatory's operations and the connection between weather data and agriculture.	
2	Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law.		Learn to measure total, shortwave, and long wave radiation and apply Planck's intensity law to estimate radiation characteristics across different wavelengths, understanding the relationship between temperature and emitted radiation.	2,3
3	Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS		Learn to measure albedo and sunshine duration, and compute radiation intensity using the Brightness-Sunshine Sum (BSS) method, applying these concepts to analyse and interpret solar radiation data for environmental and climatic studies.	2,3
4	Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.		"Students will be able to accurately measure and record maximum and minimum air temperatures, analyse the data through tabulation, and interpret trends and variations in temperature patterns, demonstrating an understanding of the factors influencing temperature changes over time."	2,3,4
5	Measurement of soil temperature and computation of soil heat flux.		Students will be able to measure soil temperature at various depths and compute soil heat flux using appropriate instruments and techniques, applying principles of thermal conductivity and soil moisture content to analyse heat transfer within the soil.	2,3,4
6	Determination of vapour pressure and relative humidity. Determination of dew point temperature.		Learn to calculate and analyse vapour pressure, relative humidity, and dew point temperature, and understand their interrelationships in the context of atmospheric science.	2,3,4

7	Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose.		Students will be able to accurately measure atmospheric pressure, wind speed, and wind direction, and analyse atmospheric conditions to create and interpret a wind rose diagram.	2,3,4
8	Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.		Students will be able to accurately measure rainfall, open pan evaporation, and evapotranspiration, while effectively tabulating and analysing the data. They will demonstrate proficiency in computing Potential Evapotranspiration (PET) and Actual Evapotranspiration (AET), and interpreting their significance in water resource management and agricultural practices.	2,3,4

TEXT BOOKS:

T1: Radhakrishnamurthy, V. 2002. Basic Principles of Agricultural meteorology. B.S Publications, Koti, Hyderabad.

T2: Radhakrishnamurthy, V. 2016. Principles and practices of agricultural disaster management. B.S Publications, Koti, Hyderabad.

REFERENCE BOOKS:

R1: Reddy, S.R. 2014. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana, Punjab.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Gain a comprehensive understanding of agricultural meteorology, including its scope and significance in agricultural production. They will be able to analyse and interpret meteorological data to support informed decisions in crop and livestock management.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Develop a detailed understanding of the Earth's atmosphere, its composition, structure, and the atmospheric weather variables such as temperature, humidity, pressure, and wind. They will be able to explain how these factors influence agriculture and weather patterns	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Acquire the skills to identify and interpret weather phenomena such as cyclones, monsoons, precipitation, and extreme weather events like heat waves and floods. They will also learn to assess their impact on agricultural systems and understand the mechanisms behind these weather events	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

4	Understanding of climate change, its causes, and the potential impacts on global and regional agriculture. They will learn how climatic variability and global warming can alter agricultural productivity and how to adapt agricultural practices to these changes	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Learn about different types of weather forecasting, their methodologies, and how these forecasts are used in agricultural planning. They will also study the process of weather forecasting for mitigating agricultural risks and optimizing production cycles	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER- IV									
Course Title	**Principles of Seed Technology**								
Course Code	**23BSAG2206R**	**Total Credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 15T + 60P	**1**	**0**	**4**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To provide a solid foundation in seed technology and various types of seed. 2. To impart knowledge on seed production in various crops. 3. To impart knowledge on seed storage and marketing and different sectors involved in seed marketing.								
CO1	Understand the concepts of quality seed production of different field and vegetable crops.								
CO2	Gain knowledge about different classes of seed and maintenance of genetic purity during seed production.								
CO3	Learn about seed certification procedure, seed drying, processing, cleaning, testing, packaging and storage.								
CO4	Acquire knowledge on seed marketing, its structure and organization, factors affecting seed marketing and the role of private and public sectors in seed marketing.								
CO5	Understand about Seed Act and its enforcement, field inspection and varietal identification through various tests.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Seed and seed technology: introduction, definition, and importance. Deterioration causes of crop varieties and their control Maintenance of genetic purity during seed production, seed quality	**2**	Learn about importance of seed, seed production and quality.	1,2
II	Definition, characters of good quality seed Different classes of seed Foundation and certified seed production of important cereals Foundation and certified seed production of important pulses Foundation and certified seed production of important oilseeds Foundation and certified seed production of important fodder Foundation and certified seed production of important vegetables	**4**	Gather knowledge about different classes of seed, foundation and certified seed production of various crops.	2,3
III	Seed certification, phases of certification, procedure for seed certification Field inspection Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983	**3**	Learn about seed certification, seed act and field inspection.	2,3

IV	Varietal Identification through Grow Out Test Varietal Identification through Grow Out Electrophoresis Molecular and Biochemical test Detection of genetically modified crops Transgene contamination in non-GM crops GM crops and organic seed production Seed drying, processing and their steps Seed testing for quality assessment Seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages Factors affecting seed longevity during storage. Measures for pest and disease control during storage	**4**	Learn about different tests to check viability of seed, seed drying, processing, testing and storage.	2,3
V	Seed marketing: structure and organization, sales generation activities, promotional media Factors affecting seed marketing Role of WTO in seed marketing Role of OECD in seed marketing Private and public sectors and their production and marketing strategies	**2**	Gain knowledge about seed marketing, factors affecting seed marketing and role of various organisations in seed marketing.	2,3
Practical				
1.	Seed production in major cereals: Wheat, Rice, Maize	**60**	Study seed production in cereals.	2,3
2.	Seed production in major cereals: Sorghum, Bajra and Ragi		Study seed production in cereals.	2,3
3.	Seed production in major pulses: Urad, Mung, Pigeonpea		Study seed production in pulses.	2,3
4.	Seed production in major pulses: Lentil, Gram, Field bean, pea.		Study seed production in pulses.	2,3
5.	Seed production in major oilseeds: Soybean, Sunflower		Study seed production in oilseeds.	2,3
6.	Seed production in major oilseeds: Rapeseed, Groundnut and Mustard.		Study seed production in oilseeds.	2,3
7.	Seed sampling and testing: Physical purity, germination, viability		Learn about seed viability tests.	2,3,4
8.	Seed and seedling vigour test		Learn about seed vigour test.	2,3,4
9.	Genetic purity test: Grow out test and electrophoresis		Study about grow out test.	2,3,4
10.	Seed certification: Procedure, Field inspection, preparation of field inspection report.		Learn procedure of seed certification and field inspection.	2,3
11.	Visit to seed production farms.		Learn about seed production.	2,3
12.	Visit to seed testing laboratories and seed processing plant		Learn about seed testing in seed testing laboratories.	2,3

TEXT BOOKS:

T1: Singh, P. 2013. Principles of Seed Technology, Kalyani Publishers

REFERENCE BOOKS:

R1: Agrawal, R.L. 2018. Seed Technology, Oxford and IBH Publishing Co Pvt. Ltd.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the concepts of quality seed production of different field and vegetable crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Gain knowledge about different classes of seed and maintenance of genetic purity during seed production.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Learn about seed certification procedure, seed drying, processing, cleaning, testing, packaging and storage.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Acquire knowledge on seed marketing, its structure and organization, factors affecting seed marketing and the role of private and public sectors in seed marketing.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Understand about Seed Act and its enforcement, field inspection and varietal identification through various tests.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – IV									
Course Title	**Farming System and Sustainable Agriculture**								
Course Code	**23BSAG2207R**	**Total Credits: 1** **Total Hours: 15T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To impart knowledge to the students on the fundamentals of farming systems and sustainable agriculture 2. To study the various components of organic agriculture. 3. To learn the fundamental principles of farming systems and sustainable agriculture and how to improve the economic condition of the farmer								
CO1	Interpret farming system and its significance.								
CO2	Design an efficient cropping system.								
CO3	Demonstrate sustainability in agriculture.								
CO4	Propose Integrated Farming System.								
CO5	Determine the efficiency of farming system.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Farming System-scope, importance and concept Types and systems of farming system and factors affecting types of farming Farming system components and their maintenance Cropping system and pattern, multiple cropping system	**3**	To understand the scope, importance, and concept of farming systems, different types and influencing factors, key components and their maintenance, and various cropping systems, including multiple cropping patterns, enhancing sustainable agricultural practices.	1,2
II	Efficient cropping system and their evaluation Allied enterprises and their importance Tools for determining production and efficiencies in cropping and farming system	**3**	To understand efficient cropping systems, evaluate allied enterprises, and identify tools for determining production and efficiency in farming systems.	1,2
III	Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability Adaptation and mitigation, conservation agriculture Strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability	**3**	To understand sustainable agriculture challenges, its impact, indicators of sustainability, adaptation and mitigation strategies, and the techniques of HEIA, LEIA, and LEISA for promoting agricultural sustainability.	1,2
IV	Integrated farming system-historical background, objectives and characteristics	**3**	To understand the historical background, objectives, characteristics, components, and advantages of Integrated Farming	1,2,3,6

	Components of IFS and its advantages Site specific development of IFS model for different agro-climatic zones		Systems (IFS) and how to develop site-specific IFS models tailored to different agro-climatic zones.	
V	Resource use efficiency and optimization techniques Resource cycling and flow of energy in different farming system, farming system and environment Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field	**3**	To understand resource use efficiency, energy flow in farming systems, and the application of optimization techniques across diverse agro-climatic zones through visits to IFS models in universities, institutes, and farmers' fields.	1,2,3

TEXT BOOKS:

T1: Reddy, S.R. Farming system and Sustainable agriculture, Kalyani Publication, New Delhi

REFERENCE BOOKS:

R1: Jayanthi C, Devasenapathy P and Vinnila, C. 2008. Farming systems principles and practice. Satish serial publishing house, Delhi

R2: Panda S.C. 2011. Cropping and farming systems. Agrobios (India) Jodhpur.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Interpret farming system and its significance.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Design an efficient cropping system.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Demonstrate sustainability in agriculture.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Propose Integrated Farming System.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Determine the efficiency of farming system.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

	SEMESTER – IV								
Course Title	**Agricultural Marketing, Trade and Prices**								
Course Code	**23BSAG2208R**	**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**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To develop a thorough understanding of agricultural marketing concepts, systems, and functions, and their role in enhancing agricultural efficiency and farmer incomes. 2. To analyse the structure and functioning of agricultural markets, including the factors influencing price determination and price volatility in domestic and international markets. 3. To assess the role and effectiveness of trade policies, international agreements, and global trade organizations in shaping agricultural trade along with marketing strategies, supply chain management, and post-harvest practices in improving market access and reducing transaction costs for agricultural producers.								
CO1	Students will be able to analyse the structure, functions, and mechanisms of agricultural markets, including marketing channels, price discovery, and market regulations.								
CO2	Students will be able to apply fundamental concepts of agricultural marketing and trade to enhance market efficiency and improve the profitability of agricultural enterprises.								
CO3	Acquiring comprehensive understanding of various types of higher financing institutions along with the functions and services provided by higher financing institutions.								
CO4	Students will be able to assess the impact of government policies, international trade agreements, and price stabilization mechanisms on agricultural marketing and pricing.								
CO5	Students will understand about the meaning, functions, and significance of agricultural prices and policies, including administered prices and the need for price regulations and analyse the impact of agricultural price policies on farmers and markets.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities, Plotting and study of demand and supply curves and calculation of elasticities.	**7**	Study of the fundamentals of agricultural marketing provides an understanding of key concepts such as market, marketing, agricultural marketing, market structure, marketing mix, and market segmentation. It explains the classification and unique characteristics of agricultural markets. Learners will analyse the nature and determinants of demand and supply for farm products, comprehend the concept of producer's surplus and its types (marketable and marketed surplus), and evaluate the factors affecting marketable surplus and its importance in agricultural marketing.	1,2
II	Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of	**6**	Learners will gain a comprehensive understanding of the Product Life Cycle (PLC), its stages, and	1,2

	PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition-based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits, Study of price behaviour over time for some selected commodities.		characteristics, enabling them to identify competitive strategies suitable for each stage. They will explore and analyse pricing approaches, such as cost-based and competition-based strategies, and evaluate various market promotion techniques, including advertising, personal selling, sales promotion, and publicity, along with their pros and cons. By integrating these insights, learners will develop the skills to design effective pricing and promotion plans tailored to diverse market conditions and business objectives.	
III	Marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products, Identification of marketing channels for selected commodity.	**5**	Learners will be able to understand the marketing process and its key components, including concentration, dispersion, and equalization. They will gain knowledge of exchange functions such as buying and selling, and physical functions like storage, transport, and processing. Learners will also explore facilitating functions such as packaging, branding, grading, quality control (including Agmark), and labelling. Additionally, they will identify the types and roles of market functionaries and understand the concept of marketing channels, their levels, and their significance for different farm products. This will enable learners to appreciate the importance of efficient marketing in the agricultural sector.	1,2
IV	Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading. Collection of data regarding marketing costs, margins and price spread and presentation of report in the class	**4**	Students will gain an understanding of market integration, efficiency, costs, and price spread in agricultural marketing, including their significance and evaluation. They will explore marketing costs, margins, and strategies to reduce expenses, alongside the government's role in agricultural marketing. Additionally, they will study the objectives and functions of public sector institutions like CWC, SWC, FCI, CACP, and DMI and understand the structure and contributions of cooperative marketing in India.	1,2

V	Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR, Application of principles of comparative advantage of international trade.		**8**	Students will develop an understanding of the risks in agricultural marketing and the tools like speculation, hedging, and futures trading used to mitigate them. It explores the meaning, functions, and importance of agricultural prices, highlighting administered pricing and the need for a price policy. It also delves into the concept of international trade, its theories (absolute and comparative advantage), and the current status and prospects of agri-commodity trade. Furthermore, the module examines the implications of GATT, WTO, and the Agreement on Agriculture (AoA) for Indian agriculture, along with the role of Intellectual Property Rights (IPR) in global agricultural trade.	2,3
Practical	1	Plotting and study of demand and supply curves and calculation of elasticities	**30**	Student will learn to analyse demand and supply curves through plotting and calculating various elasticities to understand market behaviour.	2,3
	2	Study of relationship between market arrivals and prices of some selected commodities		Student will analyse the relationship between market arrivals and prices of selected commodities to understand price fluctuations and market dynamics.	2,3
	3	Computation of marketable and marketed surplus of important commodities		Students will learn to compute marketable and marketed surplus of key agricultural commodities and analyses factors influencing their variations.	2,3
	4	Study of price behaviour over time for some selected commodities		Students will learn to analyse price behaviour trends over time for selected agricultural commodities.	2,3,4
	5	Construction of index numbers		Students will be able to understand and apply methods for constructing index numbers to analyse economic and price trends.	2,3
	6	Visit to a local market to study various marketing functions performed by different agencies		Students will learn about marketing functions performed by various agencies in a local market through direct observation and study.	2,3
	7	Identification of marketing channels for selected commodity		Students will identify and analyse appropriate marketing channels for the selected commodity to enhance market efficiency and profitability.	2,3,4
	8	Collection of data regarding marketing costs, margins and price spread and presentation of report in the class		The students will learn to analyse marketing costs, margins, and price spread, compiling and presenting findings in a structured report.	2,3,4

	9	Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning.		The students will understand about the organization and functioning of market institutions like NAFED, SWC, CWC, and cooperative marketing societies through field visits.	2,3
	10	Application of principles of comparative advantage of international trade.		The students will apply the principles of comparative advantage to analyse international trade dynamics in agricultural commodities.	2,3

TEXT BOOKS:

T1: Kahlon, A.S. and Tyagi, D.S. 1989. Agricultural Price Policy in India. Allied Publishers Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

R1: Acharya, S.S. and Agarwal, N.L. 2020. Agricultural Marketing in India. CBS Publishers and Distributors

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Students will be able to analyse the structure, functions, and mechanisms of agricultural markets, including marketing channels, price discovery, and market regulations.	1, 4, 5, 7, 8, 9, 11, 12
2	Students will be able to apply fundamental concepts of agricultural marketing and trade to enhance market efficiency and improve the profitability of agricultural enterprises.	1, 2, 3, 4, 6, 7, 8, 9, 11, 12
3	Acquiring comprehensive understanding of various types of higher financing institutions along with the functions and services provided by higher financing institutions.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
4	Students will be able to assess the impact of government policies, international trade agreements, and price stabilization mechanisms on agricultural marketing and pricing.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
5	Students will understand about the meaning, functions, and significance of agricultural prices and policies, including administered prices and the need for price regulations and analyse the impact of agricultural price policies on farmers and markets.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12

SEMESTER – IV									
Course Title	**Livestock & Poultry Management**								
Course Code	**23BSAG2209R**	**Total Credits: 4** **Total Hours: 45T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			3	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 4th Semester of Second Year of the Programme**								
Course Objectives	1. Explain the economic importance and principles of livestock management, including reproduction, housing, and breed improvement. 2. Develop practical skills in feed formulation, disease prevention, and humane animal handling. 3. Apply sustainable livestock management practices that prioritize animal welfare and industry standards.								
CO1	Apply management principles in rearing livestock and poultry, considering their economic significance								
CO2	Effectively manage reproduction, housing, and space requirements for various farm animals and poultry								
CO3	Identify, assess, and improve breeds of livestock and poultry, both indigenous and exotic								
CO4	Formulate balanced rations for livestock and poultry, incorporating feed supplements and additives								
CO5	Implement disease prevention and control measures, alongside practical skills in handling, identification, and culling								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	An introduction to agrochemicals, Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry.	**10**	Students will understand the role of livestock in the economy, reproduction principles, and housing requirements for various farm animals and poultry.	1,2
II	Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers.	**10**	Students will acquire skills in managing calves, heifers, milch animals, sheep, goats, swine, and poultry across different growth stages, including incubation and brooding.	2,3
III	Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.	**5**	Students will learn about important Indian and exotic breeds of livestock and poultry, along with strategies for their genetic improvement.	2,3
IV	Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.	**10**	Students will understand the digestion process in livestock and poultry, feed classification, nutrient functions, and formulate balanced rations using appropriate feed ingredients, supplements, and additives.	2,3
V	Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of	**10**	Students will learn about common livestock and poultry diseases, their prevention strategies, including	2,3

	important diseases of livestock and poultry.		vaccination schedules, and effective disease control measures.	
Practical				
1	External body parts of cattle, buffalo, sheep, goat, swine and poultry.	**30**	Students will develop practical skills in identifying external body parts, of cattle, buffalo, sheep, goats, swine, and poultry.	2,3
2	Handling and restraining of livestock.		Students will gain hands-on experience in safely handling and restraining various livestock species using appropriate techniques.	2,3
3	Identification methods of farm animals and poultry		Students will learn various identification methods for farm animals and poultry, including tagging, branding, tattooing, and notching.	1,2,3
4	Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.		Students will gain practical exposure by visiting IDF and IPF to study livestock and poultry breeds, observe daily farm operations, and understand farm record-keeping.	2,3
5	Judging of cattle, buffalo and poultry.		Students will develop skills in judging cattle, buffalo, and poultry based on conformation, health, and breed standards.	2,3
6	Culling of livestock and poultry.		Students will learn the principles and methods of culling livestock and poultry, focusing on animal health, productivity, and welfare.	2,3
7	Planning and layout of housing for different types of livestock.		Students will gain knowledge in planning and designing appropriate housing layouts for various types of livestock, ensuring comfort, safety, and efficiency.	2,3
8	Computation of rations for livestock.		Students will learn how to compute balanced rations for livestock, considering their nutritional requirements, growth stage, and production goals.	1,2
9	Formulation of concentrate mixtures.		Students will acquire skills in formulating concentrate mixtures for livestock, ensuring balanced nutrition to meet specific dietary needs.	2,3
10	Clean milk production, milking methods.		Students will learn the principles of clean milk production and various milking methods to ensure milk quality and hygiene.	2,3
11	Hatchery operations, incubation and hatching equipment		Students will gain practical knowledge of hatchery operations, including the use of incubation and hatching equipment to ensure successful poultry breeding.	2,3
12	Management of chicks, growers and layers		Students will learn effective management practices for chicks, growers, and layers, focusing on their	2,3

			growth, health, and productivity at different stages.	
13.	Debeaking, dusting and vaccination		Students will understand the techniques of debeaking, dusting, and vaccination in poultry, aimed at promoting health and preventing diseases.	2,3
14.	Economics of cattle, buffalo, sheep, goat, swine and poultry production		Students will learn the economic aspects of livestock and poultry production, focusing on cost analysis, profitability, and efficient resource utilization for cattle, buffalo, sheep, goat, swine, and poultry.	2,3

TEXT BOOKS:

T1: Gautam, V. N. and Shrivastava, S. (2023). A Text Book of Livestock Production and Management. Aavishkar Publishers Distributors

TEXT BOOKS:

R1: Yadav, P.K., Kumar, D. Kumar, R. and Mahesh, M.S. (2024). Handbook of Livestock & Poultry Production and Management. Narendra Publishing House.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Apply management principles in rearing livestock and poultry, considering their economic significance	2, 4, 5, 12
2	Effectively manage reproduction, housing, and space requirements for various farm animals and poultry	2, 4, 5, 11, 12
3	Identify, assess, and improve breeds of livestock and poultry, both indigenous and exotic	2, 4, 5, 12
4	Formulate balanced rations for livestock and poultry, incorporating feed supplements and additives	2, 4, 5, 11, 12
5	Implement disease prevention and control measures, alongside practical skills in handling, identification, and culling	2, 4, 5, 11, 12

SEMESTER – IV									
Course Title	**Agrochemicals**								
Course Code	**23BSAG2210R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To study the different agrochemicals used in agriculture, their role and effects on the environment 2. To study the fate, properties, structures and functions of the different classes of agrochemicals. 3. To study the regulatory frameworks governing agrochemical use at local, national, and international levels, alongside ethical issues surrounding the production and application of agrochemicals								
CO1	To impart knowledge on identification of different types of agrochemicals (e.g., fertilizers, pesticides, herbicides, fungicides) and describe their roles in enhancing crop productivity and protecting against pests and diseases.								
CO2	To impart knowledge on the principals involved in the chemical function of agrochemicals								
CO3	To impart knowledge on the process of manufacturing of agrochemicals.								
CO4	To impart knowledge on various categories of agro-chemicals and safety measures.								
CO5	To impart knowledge on the categorizing of the bio-pesticides and their importance in sustainable agriculture								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides - Major classes, properties and important herbicides Fate of herbicides.	**4**	Understand the types, roles, benefits and risks of agrochemicals, their environmental and health impacts, sustainable management, major herbicide classes, and their fate in the environment.	1,2
II	Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper. Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates, characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use	**7**	Learn the classification, characteristics, preparation, and use of inorganic, organic, and systemic fungicides, including key examples like sulfur, copper compounds, Dithiocarbamates, and systemic fungicides.	1,2

III	Introduction and classification of insecticides: inorganic and organic insecticides. Organochlorine, Organophosphates, Carbamates Synthetic pyrethroids Neonicotinoids, Biorational Insecticide Act and rules, Insecticides banned, withdrawn and restricted use Fate of insecticides in soil & plant IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses	**7**	Understand the classification of insecticides, key groups, regulations, banned and restricted use, their fate in soil and plants, and the characteristics and uses of IGRs, biopesticides, botanicals, and systemic insecticides.	1,2
IV	Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate Mixed and complex fertilizers: Sources and compatibility– preparation of major, secondary and micronutrient mixtures Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing	**10**	Learn the types and manufacturing process of nitrogenous, phosphatic, and potassic fertilizers, including slow-release N-fertilizers. Also learn mixed and complex fertilizers, their sources, compatibility, and preparation. Fertilizer Control Order, logistics, and marketing.	1,2
V	Plant bio-pesticides for ecological agriculture. Bio-insect repellent	**2**	Knowledge of plant-based bio-pesticides and bio-insect repellents, highlighting their role in ecological agriculture, characteristics, and applications for sustainable pest management.	1,2
Practical				
1	Sampling of fertilizers and pesticides	**30**	Students will learn how to collect representative samples of fertilizers and pesticides for analysis, ensuring accurate results for quality control, testing, and compliance with regulations.	2,3
2	Pesticides application technology to study about various pesticides appliances		Understand the application methods of various pesticides and pesticide appliances	2,3
3	Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer.		Practical knowledge of fertilizer identification and identification of anion and cations in fertilizers	2,3

4	Calculation of doses of insecticides to be used		Understanding of insecticide dose calculation through numericals.	2,3,4
5	To study and identify various formulations of insecticide available in market		Learn about various market available insecticide formulations	2,3
6	Estimation of nitrogen in Urea		Practical knowledge of nitrogen analysis in urea	2,3
7	Estimation of water soluble P_2 O_5 and citrate soluble P_2 O_5 in single super phosphate		Practical knowledge of estimating water soluble P_2 O_5 and citrate soluble P_2 O_5 in single super phosphate	2,3
8	Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer		Learn the application of flame photometer for eestimation of potassium in Muraite of Potash/ Sulphate of Potash	2,3
9	Determination of copper content in copper oxychloride		Practical knowledge of determining copper content in copper oxychloride	2,3
10	Determination of sulphur content in sulphur fungicide		Practical knowledge of determining of sulphur content in sulphur fungicide.	2,3
11	Determination of thiram content		Learn the method of determination of thiram requirement.	2,3
12	Determination of ziram content		Learn the method of determination of ziram requirement.	2,3

TEXT BOOKS:

T1: Ravichandra, N.G. (2018). Agrochemicals in Plant Disease Management, Scientific Publishers

REFERENCE BOOKS:

R1: Montgomery, J.H. Agrochemicals Desk Reference. Taylor & Francis Inc

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	To impart knowledge on identification of different types of agrochemicals (e.g., fertilizers, pesticides, herbicides, fungicides) and describe their roles in enhancing crop productivity and protecting against pests and diseases.	1, 4, 8, 9
2	To impart knowledge on the principals involved in the chemical function of agrochemicals	1, 4, 12
3	To impart knowledge on the process of manufacturing of agrochemicals.	1, 2, 4, 5, 8, 12
4	To impart knowledge on various categories of agro-chemicals and safety measures.	1, 2, 4, 5, 6, 8, 9
5	To impart knowledge on the categorizing of the bio-pesticides and their importance in sustainable agriculture	1, 2, 3, 4, 5, 6, 8

SEMESTER – IV										
Course Title	**Bio pesticides & Bio fertilizers**									
Course Code	**23BSAG2210R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To learn about the importance of Bio pesticides and bio fertilizers 2. To provide knowledge of Mass production technology of bio-pesticides and bio fertilizers 3. To learn about the importance and storage of bio fertilizers and bio agents								
CO1	Define key concepts and terminologies related to bio pesticides and bio fertilizers.								
CO2	Recall the historical developments and principles underlying the use of bio pesticides and bio fertilizers.								
CO3	Demonstrate practical knowledge in the production, storage, and application of bio pesticides and bio fertilizers.								
CO4	Analyse the limitations and quality control measures associated with bio fertilizers and bio pesticides usage.								
CO5	Evaluate the economic and ecological benefits of adopting bio-based agricultural inputs over synthetic alternatives.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	History and concept of bio pesticides Importance, scope and potential of bio pesticides. Definitions, concepts and classification of bio pesticides viz. pathogen, botanical pesticides, and bioregional. Botanicals and their uses	**5**	Gain knowledge of the history, importance, and potential of bio pesticides in sustainable agriculture. Understand the definitions and classifications of bio pesticides, including pathogens, botanical pesticides, and bioregional. Recognize the role and applications of botanical pesticides in pest control.	1,2
II	Mass production technology of bio-pesticides, Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes, Methods of application of bio pesticides, Methods of quality control and Techniques of bio pesticides. Impediments and limitation in production and use of bio pesticides.	**8**	Gain an understanding of the mass production technology of biopesticides, including methods for ensuring their quality and effectiveness. Comprehend the virulence, pathogenicity, and symptoms caused by entomopathogenic pathogens and nematodes. Additionally, explore the diverse application techniques of biopesticides and examine the challenges and limitations in their production and usage for sustainable pest management.	1,2
III	Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*, Cyanobacterial	**5**	Students will understand the introduction, status, and scope of biofertilizers in sustainable agriculture. They will recognize the structure and characteristics of bacterial biofertilizers such as *Azospirillum*, *Azotobacter*, *Bacillus*,	2,3

	biofertilizers- *Anabaena, Nostoc, Hapalosiphon* Fungal biofertilizers- AM mycorrhiza and ectomycorrhiza		*Pseudomonas, Rhizobium,* and *Frankia,* as well as cyanobacterial biofertilizers like *Anabaena, Nostoc,* and *Hapalosiphon.* Additionally, they will explore fungal biofertilizers, including AM mycorrhiza and ectomycorrhiza, and their roles in improving soil fertility and plant health.	
IV	Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, Mass production of carrier based and liquid biofertilizers.	**6**	Students will understand the processes of free-living and symbiotic nitrogen fixation, the mechanisms of phosphate solubilization, phosphate mobilization, and potassium solubilization. They will gain knowledge of production technology, including strain selection, sterilization, growth, fermentation, and the mass production of carrier-based and liquid biofertilizers.	2,3
V	FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.	**6**	Students will understand FCO specifications and quality control measures for biofertilizers. They will learn application techniques for seeds, seedlings, tubers, and sets, along with storage, shelf life, and marketing of biofertilizers. Additionally, they will explore factors influencing the efficacy of biofertilizers in agricultural practices.	1,2
Practical				
1	Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyziu*m etc. and its production.	**30**	Develop skills in isolating and purifying key biopesticides such as *Trichoderma, Pseudomonas, Bacillus,* and *Metarhizium.* They will gain hands-on experience in their production processes, including culture techniques and maintaining purity for effective use in pest management.	2,3
2	Identification of important botanicals		Acquire the ability to identify important botanical pesticides, recognize their key characteristics, and understand their potential applications in sustainable pest management practices.	2,3
3	Visit to biopesticide laboratory in nearby area.		Gain firsthand experience by visiting a biopesticide laboratory, observing the processes involved in biopesticide production, quality control, and research. They will enhance their understanding of the practical applications and technologies used in the development of biopesticides.	2,3
4	Field visit to explore naturally infected cadavers.		Explore naturally infected cadavers during a field visit, observing the signs of infection caused by entomopathogenic pathogens. They	2,3

			will gain practical insights into the identification and study of pest control mechanisms in natural environments.	
5	Identification of entomopathogenic entities in field condition.		Develop the ability to identify entomopathogenic entities in field conditions, recognizing signs of pest infection caused by natural pathogens.	2,3
6	Quality control of biopesticides.		Understand the methods for quality control of biopesticides, ensuring their efficacy and safety for use in pest management.	2,3
7	Isolation and purification of *Azospirillum , Azotobacter, Rhizobium, P-solubilizers* and *Cyanobacteria*		Acquire practical skills of isolation and purification of *Azospirillum , Azotobacter, Rhizobium, P-solubilizers* and *Cyanobacteria*	2,3
8	Mass multiplication and inoculums production of biofertilizers.		Acquire practical skills in the mass multiplication and inoculum production of biofertilizers, understanding the techniques and conditions necessary for large-scale production.	2,3
9	Isolation of AM fungi -Wet sieving method and sucrose gradient method.		Gain skills in isolating AM fungi using the wet sieving and sucrose gradient methods, understanding the procedures for efficient fungal separation.	2,3
10	Mass production of AM inoculants.		Gain hands-on experience in the mass production of AM inoculants, including the techniques and conditions necessary for large-scale cultivation and inoculation.	2,3

TEXT BOOKS:

T1: Acharya, K., Sen,S. Rai,M. (2019). Biofertilizers and Biopesticides. Techno World; First Edition

REFERENCE BOOKS:

R1: Khosla,R. (2017). Biofertilizers and Biocontrol Agents for Organic Farming. Kojo Press

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Define key concepts and terminologies related to biopesticides and biofertilizers.	1, 3, 4, 5, 6, 7, 12
2	Recall the historical developments and principles underlying the use of biopesticides and biofertilizers.	1, 2, 3, 4, 5, 6
3	Demonstrate practical knowledge in the production, storage, and application of biopesticides and biofertilizers.	1, 3, 4, 5, 6
4	Analyse the limitations and quality control measures associated with biofertilizers and biopesticides usage.	1, 2, 3, 4, 5, 6, 7, 8, 10, 12
5	Evaluate the economic and ecological benefits of adopting bio-based agricultural inputs over synthetic alternatives.	1, 2, 3, 4, 5, 6, 7, 8, 10, 12

SEMESTER- IV									
Course Title	**Micropropagation Technologies**								
Course Code	**23BSAG2210R**	**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**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To provide students with foundational knowledge of plant tissue culture techniques, including micro-propagation, somatic embryogenesis, and organogenesis, and their applications in agriculture and biotechnology. 2. To develop practical skills in laboratory procedures such as media preparation, sterilisation, explant culturing, and plant regeneration, ensuring competence in handling tissue culture processes. 3. To enable students to explore the potential of tissue culture in plant conservation, genetic improvement, production of secondary metabolites, and large-scale propagation of elite plant varieties.								
CO1	Gain a thorough understanding of plant tissue culture principles and techniques, including micro-propagation, somatic embryogenesis, and organogenesis.								
CO2	Develop proficiency in laboratory practices such as media preparation, sterilisation, explant culturing, and plant regeneration.								
CO3	Apply tissue culture techniques for secondary metabolite production, somaclonal variation studies, and plant genetic resource conservation through cryopreservation.								
CO4	Acquire skills relevant to plant biotechnology, horticulture, and agriculture careers.								
CO5	Prepare for advanced research in genetic improvement, sustainable crop production, and plant conservation.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction and history of micro-propagation	**5**	Students will gain an understanding of the fundamentals and historical development of micro-propagation techniques, enabling them to appreciate their significance in plant biotechnology and their evolution as a tool for large-scale plant production and genetic improvement.	1,2
II	Cell structure, chemo-autotrophy, photo autotrophy, and growth.	**7**	Students will be able to identify and differentiate various plant tissue cultures, such as seed, embryo, organ, callus, and cell cultures, while understanding their advantages, limitations, and practical applications in biotechnology and agriculture.	2,3
III	Stages of micro-propagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture)	**7**	Students will understand the stages of micro-propagation and acquire knowledge of axillary bud proliferation techniques, including shoot tip, meristem, and bud culture. This will enable them to apply these methods for effective plant propagation and regeneration.	2,3

IV	Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures,	**5**	Students will gain knowledge of organogenesis, including callus and direct organ formation, somatic embryogenesis, and cell suspension cultures, enabling them to apply these techniques for plant regeneration, large-scale propagation, and research in plant developmental biology.	2,3
V	Production of secondary metabolites, Somaclonal variation, Cryopreservation.	**6**	Students will understand the processes involved in producing secondary metabolites, the significance of somaclonal variation in plant improvement, and the principles of cryopreservation for the long-term conservation of plant genetic resources, equipping them with advanced tools for research and industrial applications.	2,3
Practical				
1.	Identification and proper use of equipment in the tissue culture laboratory.	**30**	Identify and properly use essential equipment in the tissue culture laboratory.	2,3
2.	Preparation and composition of nutritional media for plant tissue culture.		Understand the composition and role of nutritional media in plant tissue culture.	2,3
3.	Sterilisation techniques for culture media to ensure aseptic conditions.		Demonstrate proficiency in sterilisation techniques for culture media.	2,3
4.	Selection and sterilisation of containers and small instruments for tissue culture.		Select and sterilise containers and small instruments used in tissue culture.	2,3
5.	Sterilisation techniques for explants to prevent contamination.		Apply effective sterilisation methods to prevent contamination of explants.	2,3
6.	Preparation of stock solutions and working solutions for media formulation.		Prepare stock and working solutions for media formulation.	2,3
7.	Preparation and sterilisation of working media for tissue culture experiments.		Develop skills in preparing and sterilising working media for plant tissue culture.	2,3
8.	Culturing of explants, including seeds, shoot tips, and single nodes.		Explant culturing techniques use seeds, shoot tips, and single nodes.	2,3
9.	Induction of callus formation from different plant tissues.		Induce and maintain callus formation from different plant tissues.	2,3

10.	Initiation of somatic embryogenesis for plant regeneration.		Initiate and manage somatic embryogenesis for plant regeneration.	2,3
11.	Regeneration of whole plants from various explants using tissue culture techniques.		Regenerate whole plants from explants through tissue culture techniques.	2,3,6
12.	Hardening procedures for acclimatising tissue-cultured plants to external environments.		Implement hardening procedures to acclimate tissue-cultured plants to external conditions successfully.	2,3,6

TEXT BOOKS:

T1: Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice. Elsevier

REFERENCE BOOKS:

R1: Gamborg, O.L. and Phillips, G.C. 1995 Plant Cell, Tissue, and Organ Culture: Fundamental Methods. Springer.

R2: Plant Biotechnology and Genetics: Principles, Techniques, and Applications by C. Neal Stewart Jr. is a well-structured book that discusses the integration of tissue culture techniques with modern plant biotechnology applications

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Gain a thorough understanding of plant tissue culture principles and techniques, including micro-propagation, somatic embryogenesis, and organogenesis.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Develop proficiency in laboratory practices such as media preparation, sterilisation, explant culturing, and plant regeneration.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Apply tissue culture techniques for secondary metabolite production, somaclonal variation studies, and plant genetic resource conservation through cryopreservation.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Acquire skills relevant to plant biotechnology, horticulture, and agriculture careers.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Prepare for advanced research in genetic improvement, sustainable crop production, and plant conservation.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – IV										
Course Title	**Protected Cultivation**									
Course Code	**23BSAG2210R**	**Total Credits: 03** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. This course provides an in-depth understanding of modern techniques in protected cultivation to enhance horticultural crop productivity. 2. The course offers the importance, scope, and status of protected cultivation globally and in India, along with types of protected structures like green house and poly house, cladding materials, and greenhouse design. 3. This course offers practical insights, and innovative approaches prepare students for research and professional roles in sustainable horticulture.									
CO1	Understand the importance, scope, and status of protected cultivation globally and in India.									
CO2	Design, construct, and manage protected structures, including greenhouses and polyhouses, with appropriate cladding materials and automation technologies.									
CO3	Implement advanced irrigation, fertigation, soil, and substrate management techniques for sustainable crop production.									
CO4	Develop strategies for off-season production and effective pest and disease management in protected cultivation systems.									
CO5	Apply scientific knowledge and technological innovations to enhance productivity and profitability in horticulture.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate.	**6**	Study on soil and water conservation, agents of different erosions.	1,2
II	Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management.	**6**	Study on various soil erosion control measures, soil loss measurement techniques and their calculation.	2,3
III	Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.	**6**	Study and familiarization with contouring, strip cropping, contour bunds and their design.	2,3
IV	Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.	**6**	Study on mechanics of wind erosion and types of soil movement.	2,3
V	Cultivation of economically important medicinal and aromatic plants, Off-season production of flowers and vegetables. Insect pest and disease management.	**6**	Study on principles of wind erosion and their control measures and application of wind energy.	2,3
Practical				

1	Raising of seedlings and saplings under protected conditions.	**30**	Learners will understand the techniques of raising seedlings and saplings under protected conditions, ensuring optimal growth and survival rates. They will gain practical knowledge of soil preparation, irrigation regulation through different methods, and fertilizer management for quality planting material production. Learners will develop skills in measuring soil EC and pH, conducting intercultural operations, and using portrays for efficient crop establishment and production.	1,2,3
2	Use of portrays in quality planting material production.			
3	Bed preparation and planting of crop for production.			
4.	Inter cultural operations.			
5.	Soil EC measurement.			
6.	Soil pH measurement.			
7.	Regulation of irrigation and fertilizers through drip			
8.	Regulation of irrigation and fertilizers through fogging			
9.	Regulation of irrigation and fertilizers through misting.			

TEXT BOOKS:

T1: Jha, M.K., Paikra, S.S., S. and Sahu, M.R. 2019. Protected cultivation of Horticultural crops. Educreation Publishing.

T2: Prabhakar, I. 2020. Protected Cultivation of Horticulture Crops. Satish serial Publishing House

T3: Sindhu, V., Ashok Kumar, B., Ramesh, E.. 2020. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops. Science Technology

REFERENCE BOOKS:

R1: Nelson, P.V. 2013. Greenhouse operation and management. Pearson.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the importance, scope, and status of protected cultivation globally and in India.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Design, construct, and manage protected structures, including greenhouses and polyhouses, with appropriate cladding materials and automation technologies.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Implement advanced irrigation, fertigation, soil, and substrate management techniques for sustainable crop production.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Develop strategies for off-season production and effective pest and disease management in protected cultivation systems.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Apply scientific knowledge and technological innovations to enhance productivity and profitability in horticulture.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER- IV									
Course Title	**English for Employability**								
Course Code	**23UBPD2202R**	**Total Credits: 2** **Total Hours: 60P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring / 4th Semester of Second Year of the Programme**								
Course Objectives	1. To strengthen and expand the vocabulary of the students which will help them in writing and speaking English. 2. To improve learners' overall communicative skills and fluency in the target language 3. To enable the students with the knowledge and skills to create well-crafted resumes that effectively showcase their qualification								
CO1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.								
CO2	Prepare for various public and private sector exams & placement drives. To enhance the analytical skill and problem-solving skill of the students								
CO3	Provide insight into networking platforms to help students build and expand their professional connection.								
CO4	Apply the basic rules for flawless speaking and writing and using the exact contextual								
CO5	Know different effective presentation techniques to write or give presentation in a flawless manner.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Alligation and mixture. Permutation & Combination**. i) Concept of mixing and alligating ii) Short tricks On Alligation and mixture iii) Problem discussion and exercise	**10**	This course will help students to understand Numerical Reasoning ability to solve problem and preparation Exam	1,2
II	**Algebric Equation and Mensuration** i) Quadratic equation ii) Cubic equation iii) Equation and its application iv) Area, volume and Its application	**15**	This course will help students to understand different equations concept and to improve them with an proper example.	1,2
III	**Statement and course of action** i) Understanding situation-based question. ii) Analysis and problem solving of the question **iii)** Exercise discussion.	**10**	This course will help students to understand Reasoning analytic and critical thinking ability. This will help them to prepare for any exam.	1,2
IV	**Clock and Seating Arrangement** i) Concept of 12 hr and 24 hr clock. ii) Concept of left and right position. iii) Understanding of linear and circulation arrangement. **iv)** Exercises and problem discussion.	**15**	This course will help students to understand reasoning ability. This will help them to prepare for any exam.	1,2
V	**Probability and Data interpretation** i) Data interpretation ii) Probability **iii)** Mean-Mode-Median	**10**	This course will help students to understand Geometrical plan ability. This will help them to prepare for any exam.	2,3

TEXT BOOKS:

T1: Barrett, G. 2016. Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking, Zephyros Press.
T2: Mishra, S. and Murlikrisna, C. 2011. Communication Skills for Engineers, Pearson.
T3: Wren, P.C. and Martin, H. 1995. High School English Grammar and Composition, S Chand Publishing.
T4: Laakmann, M.G. 2008. Cracking the Coding Interview (Indian Edition)

REFERENCE BOOKS:

R1: Zinsser, W. 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: Parikh J.P, Anshu, S. Swarnabharati, B. 2011. Business Communication, Orient Black Swan.
R4: Murphy, R. 2012. English Grammar in Use Book with Answers: A Self- Study and Practice Book for Intermediate Learners of English, Cambridge University Press
R5: Agarwal, R.S. 2024. A Modern Approach to Logical Reasoning. S. Chand & Co.
R6: Agarwal, R.S. 2017. Quantitative Aptitude. S. Chand & Co.

OTHER LEARNING RESOURCES:

1. https://learning.shine.com/talenteconomy/career-help/top-group-discussion-skills/https://www.coursera.org/articles/conflict-management

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.	3
2	Prepare for various public and private sector exams & placement drives. To enhance the analytical skill and problem-solving skill of the students	3
3	Provide insight into networking platforms to help students build and expand their professional connection.	3
4	Apply the basic rules for flawless speaking and writing and using the exact contextual	3
5	Know different effective presentation techniques to write or give presentation in a flawless manner.	3

SEMESTER – V									
Course Title	**Principles of Integrated Pest and Disease Management**								
Course Code	**23BSAG3101R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To provide a comprehensive understanding of the concepts, principles, and tools of IPM, including the historical development and importance of IPM in managing insect pests and diseases. This includes exploring various control methods such as host plant resistance, biological, cultural, and chemical control, and their role in sustainable agriculture. 2. To equip the students with the skills for assessing the economic importance of insect pests and diseases, calculate the economic injury level (EIL), and understand the concept of the economic threshold level (ETL). Students will also gain knowledge on pest risk analysis, helping them make informed decisions regarding pest management. 3. To guide the students in the development, validation, and implementation of IPM modules, with a focus on surveying, surveillance, and forecasting insect pest and disease outbreaks. Emphasis will be placed on the practical application of IPM strategies, as well as understanding the safety, social, legal, and political implications of pesticide use in pest management.								
CO1	Students learn about the historical context and importance of Integrated Pest Management (IPM), along with its concepts, principles, and tools, gaining insights into insect pests and diseases.								
CO2	Acquiring knowledge about the economic significance of pests and diseases, pest risk analysis, detection methods, and calculation of economic injury and threshold levels								
CO3	Comprehensive understanding of pest management strategies, including resistance, cultural practices, mechanical and biological controls								
CO4	Students develop skills to monitor, predict, and mitigate pests and diseases through survey surveillance and forecasting methods								
CO5	Understanding safety protocols in pesticide application and socio-economic dimensions of IPM, ensures responsible and effective pest control practices in agriculture.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Introduction to Insect Pests and Diseases & Basics of IPM** **Categories of Insect Pests and Diseases:** Insect pests (e.g., herbivores, pollinators, etc.)**.** Plant diseases (fungal, bacterial, viral, etc.)**.** Nematodes and other pests**. Overview of IPM:** Definition and scope of IPM (Integrated Pest Management)**.** History and evolution of IPM**.** Importance of IPM in modern agriculture and environmental protection**.** Concepts and principles of IPM (prevention, monitoring, action thresholds, etc.)**. Tools of IPM:** Cultural, mechanical, biological, and	**6**	Students will be able to identify and categorize various insect pests, plant diseases, and other pests, and demonstrate an understanding of the key principles of Integrated Pest Management (IPM). This includes recognizing the historical development of IPM, the importance of IPM in sustainable agriculture, and the application of its various tools—cultural, mechanical, biological, and chemical—along with the concepts of economic thresholds	1,2

	chemical tools**.** Economic thresholds and injury levels		and injury levels in pest management.	
II	**Economic Importance of Insect Pests and Diseases.** Direct losses (yield reduction, quality degradation)**.** Indirect losses (cost of control, pesticide resistance) **Pest Risk Analysis:** Methods of risk assessment for pests and diseases**.** Understanding pest introduction and spread in new areas**. Economic Injury Level (EIL) & Economic Threshold Level (ETL):** Definitions and calculations**.** Importance of EIL and ETL in making pest management decisions.	**7**	Learners will be able to understand the economic impact of insect pests and diseases, differentiate between direct and indirect losses, apply methods of pest risk analysis, and accurately calculate and interpret the Economic Injury Level (EIL) and Economic Threshold Level (ETL) to make informed pest management decisions.	1,2
III	**Detection, Diagnosis, and Surveillance of Pests and Diseases. Methods of Detection and Diagnosis:** Field scouting techniques Laboratory-based diagnostic methods (microscopic examination, DNA barcoding, etc.)**.** Role of technology in detection (remote sensing, digital tools)**. Survey and Surveillance:** Methods of pest monitoring (traps, pheromones, sampling)**.** Forecasting pest outbreaks and disease epidemics**.** Role of weather and environmental data in pest prediction.	**7**	Learners will be able to identify and apply various methods for detecting, diagnosing, and monitoring pests and diseases, utilizing both traditional field-based techniques (e.g., scouting, trapping) and advanced technological tools (e.g., remote sensing, digital platforms), and understand how environmental factors and forecasting models contribute to pest and disease prediction and management strategies.	1,2,3
IV	**Methods of Control in IPM- Control Strategies: Host Plant Resistance:** Genetic resistance, biotech solutions**. Cultural Control:** Crop rotation, intercropping, soil management, etc. **Mechanical and Physical Control:** Barriers, traps, mulching, heat treatments**. Legislative Control:** Quarantine, import regulations, pesticide regulations**. Biological Control:** Use of natural enemies (predators, parasitoids, pathogens)**. Chemical Control:** Conventional pesticides, alternatives (e.g., biopesticides)**. Ecological Management of Crop Environment:** Habitat manipulation for pest control (e.g., providing refuge for beneficial organisms)**.** Integrated farming systems for sustainability.	**7**	Students will be able to identify and evaluate various methods of control in Integrated Pest Management (IPM), including host plant resistance, cultural practices, mechanical and physical controls, biological control, chemical control, legislative measures, and ecological management strategies, and understand their roles in promoting sustainable agricultural practices.	2,3
V	**Implementation, Safety, and Case Studies in IPM.** Development and Validation of IPM Modules. Designing and tailoring IPM strategies for specific crops or regions. Validation of IPM modules through trials and field testing.	**3**	Students will be able to design, implement, and assess Integrated Pest Management (IPM) strategies tailored to specific crops or regions, evaluating the effectiveness of these strategies in	2,3

	Impact of IPM:Assessing effectiveness (reduced pesticide use, increased yield). Long-term environmental and economic impact. Safety Issues in Pesticide Use: Health risks to humans and non-target organisms. Safety protocols and handling practices for pesticide use. Political, Social, and Legal Implications of IPM: Policy support and challenges in implementing IPM. Social acceptance and legal regulations around IPM and pesticide use. Case Histories of Important IPM Programs: Successful IPM programs from different parts of the world (e.g., rice, cotton, vegetables). Lessons learned from real-world implementations		terms of reduced pesticide use, increased yield, and long-term environmental and economic sustainability. Students will also understand the safety protocols for pesticide use, as well as the political, social, and legal factors influencing IPM implementation, drawing from case studies of successful IPM programs globally.	
Practical				
1	Methods of diagnosis and detection of various insect pests and plant diseases.	**4**	Students will be able to identify common insect pests and plant diseases through visual symptoms, diagnostic tools, and laboratory techniques, enabling them to apply effective control measures in agricultural or horticultural settings.	1,2,3
2	Methods of insect pests and plant disease measurement	**4**	Students will be able to accurately identify and apply various methods for measuring insect pest populations and assessing plant disease severity, using both quantitative and qualitative techniques to monitor agricultural health.	1,2,3
3	Assessment of crop yield losses, calculations based on economics of IPM	**4**	Students will be able to assess crop yield losses due to pest and disease infestations, calculate economic losses, and apply Integrated Pest Management (IPM) strategies to optimize crop production while minimizing economic impacts.	2,3
4	Identification of biocontrol agents, different predators and natural enemies.	**4**	Students will be able to identify various biocontrol agents, including predators and natural enemies, and understand their role in managing pest populations in different ecosystems.	2,3
5	Mass multiplication of, Trichoderma, Pseudomonas, Trichogramma, NPV etc.	**3**	Students will be able to effectively mass produce and apply biocontrol agents such as *Trichoderma*, *Pseudomonas*, *Trichogramma*, and *NPV* for sustainable pest and disease management, demonstrating an understanding of the	2,3

			methodologies, equipment, and environmental considerations involved in the production process."	
6	Identification and nature of damage of important insect pests and diseases and their management.	**2**	Learners will be able to identify key insect pests and diseases that affect crops, understand the nature of the damage they cause, and apply appropriate management strategies to control or mitigate their impact on agricultural production.	1,2,3
7	Crop (agroecosystem) dynamics of a selected insect pest and diseases.	**4**	Students will be able to analyse the dynamics of insect pest and disease populations in agroecosystems, identify key factors influencing their development, and propose integrated pest management strategies for effective crop protection.	2,3,4
8	Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases	**4**	Learners will be able to develop and implement an integrated pest management (IPM) strategy for crop protection, effectively monitor crops for insect, pest, and disease threats, and make informed, sustainable decisions based on regular assessments and pest thresholds to reduce the environmental impact and increase crop yield.	2,3,6
9	Awareness campaign at farmers' fields.	**1**	Farmers will be able to identify and implement sustainable farming practices that improve soil health, reduce environmental impact, and increase crop yield.	2,3

TEXT BOOKS:

1. Trivedi, P.C. 2011. Bioagents in Plant disease management.

REFERENCE BOOKS:

1. Dutta, P., Tamuli, P., Kaushik, H. 2015. Crop Diseases and their Management Strategies. Aavishakar Publishers
2. Singh, R.S. 2024. Plant Diseases. 11th edition. Medtech Science Press.
3. Nene, Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control, 4th edition. Medtech/ Generic

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Students learn about the historical context and importance of Integrated Pest Management (IPM), along with its concepts, principles, and tools, gaining insights into insect pests and diseases.	1, 2, 4, 5, 6, 10
2	Acquiring knowledge about the economic significance of pests and diseases, pest risk analysis, detection methods, and calculation of economic injury and threshold levels	1, 2, 3, 4, 7, 8, 9, 10
3	Comprehensive understanding of pest management strategies, including resistance, cultural practices, mechanical and biological controls	1, 2, 4, 6, 8, 10, 11
4	Students develop skills to monitor, predict, and mitigate pests and diseases through survey surveillance and forecasting methods	1, 2, 4, 5, 8, 9
5	Understanding safety protocols in pesticide application and socio-economic dimensions of IPM, ensures responsible and effective pest control practices in agriculture.	1, 2, 3, 4, 5, 6, 9

SEMESTER – V									
Course Title	**Soil and Water Conservation Engineering**								
Course Code	**23BSAG3102R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. Provide a comprehensive study of erosion processes and control measures. 2. To understand theoretical aspects such as causes of soil erosion and practical skills like designing erosion control structures. 3. Understand to analyse contour maps for effective intervention planning and evaluate soil conservation practices in real-world contexts								
CO1	Understand and apply erosion control measures for both water and wind erosion.								
CO2	Calculate erosion indices and estimate soil loss using USLE, employing measurement techniques.								
CO3	Design erosion control structures like contour bunds, graded bunds, and bench terracing.								
CO4	Analyse contour maps for identifying suitable locations for erosion control and water harvesting.								
CO5	Evaluate soil conservation practices in India through practical exercises and problem-solving.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion.	**2**	Study on soil and water conservation, agents of different erosions.	1,2
II	Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control.	**3**	Study on various soil erosion control measures, soil loss measurement techniques and their calculation.	2,3
III	Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design.	**5**	Study and familiarization with contouring, strip cropping, contour bunds and their design.	2,3
IV	Wind erosion: mechanics of wind erosion, types of soil movement.	**2**	Study on mechanics of wind erosion and types of soil movement.	2,3
V	Principles of wind erosion control and its control measures. Introduction of wind energy and their application	**3**	Study on principles of wind erosion and their control measures and application of wind energy.	2,3
Practical				
1	Introduction to status of soil conservation in India.	**30**	Study on status of soil conservation in India.	2,3
2	Calculation of erosion index.		Estimation on soil erosion index.	2,3,4
3	Estimation of soil loss.		Introduction to soil loss and their estimation.	2,3,4
4.	Measurement of soil loss.		Calculation of soil loss.	2,3,4

5.	Preparation of contour maps.		Study on different techniques used on contour mapping.	2,3,4
6.	Design of grassed water ways.		Study on various design on grassed water ways.	2,3
7.	Design of contour bunds.		Introduction to contour bunds and their design.	2,3
8.	Design of graded bunds.		Understand the design of graded bunds.	2,3
9.	Design of bench terracing system		Study about bench terracing system and their design.	2,3
10.	Problem on wind erosion.		Study on various issues related to wind erosion and their prevention.	2,3

TEXT BOOKS:

T1: Das, G. 2009. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi

T2: Michael, A. M. 2008. Irrigation Theory and Practice, S. Chand & Co.

REFERENCE BOOKS:

R1. James, L. G. 1988. Principles of Farm Irrigation System Design, John Wiley and Sons, USA.

R2. Walker, W.R. and Skogerboe, Q. V. 1987. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand and apply erosion control measures for both water and wind erosion.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
2	Calculate erosion indices and estimate soil loss using USLE, employing measurement techniques.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
3	Design erosion control structures like contour bunds, graded bunds, and bench terracing.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
4	Analyse contour maps for identifying suitable locations for erosion control and water harvesting.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
5	Evaluate soil conservation practices in India through practical exercises and problem-solving.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12

SEMESTER – V									
Course Title	**Pests of Crops and Stored Grains and their Management**								
Course Code	**23BSAG3103R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. This course provides a thorough understanding of managing arthropod pests in agriculture. 2. Through theoretical and practical components, students learn to identify, analyse, and control pests across crops and storage facilities. 3. From studying pest biology to implementing effective management strategies, learners acquire the skills necessary to tackle pest challenges comprehensively.								
CO1	Understand and manage diverse arthropod pests across crops.								
CO2	Analyse life cycles of insect pests in agricultural settings.								
CO3	Evaluate factors affecting stored grain losses and apply management techniques.								
CO4	Identify and control pests associated with stored grain effectively.								
CO5	Apply practical methods for assessing infestation, calculating doses, and managing storage structures.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	General account on nature and type of damage by different arthropods pests.	**4**	Students will learn the basics of the nature and type of damage by different arthropods pests.	1,2
II	Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments.	**8**	Students will gain knowledge on the scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests. They will also gain knowledge on the important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments.	1,2,3
III	Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.	**6**	Gain understanding on the Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.	2,3
IV	Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.	**6**	Gain knowledge on Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.	2,3
V	Storage structure and methods of grain storage and fundamental principles of grain store management.	**6**	Gain knowledge on different storage methods and structures, learn the fundamental principles of grain store management	2,3
Practical				

1	Identification of different types of damage	**30**	Study on various different types of damage symptoms	1,2
2	Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops		Study the details on identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce of Field Crops	1,2,3
3	Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (b) Vegetable Crops; (c) Fruit Crops		Study the details on identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce of Vegetable and Fruit Crops	1,2,3
4.	Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (d) Plantation, gardens, Narcotics, spices & condiments.		Study the details on identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce of Plantation, gardens, narcotics, spices and condiments	1,2,3
5.	Identification of insect pests and Mites associated with stored grain.		Study on Identification of insect pests and Mites associated with stored grain.	1,2
6.	Determination of insect infestation by different methods.		Study on determination of insect infestation by different methods.	2,3
7.	Assessment of losses due to insects.		Study on calculation of losses due to insects.	2,3,4
8.	Calculations on the doses of insecticides application technique		Study on calculations on the doses of insecticides application technique	2,3,4
9.	Fumigation of grain store / godown		Study on Fumigation of grain store/ godown	2,3
10.	Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns.		Study on Identification of rodents, birds, rodent control operations, birds control operation in godowns	1,2
11.	Determination of moisture content of grain		Gain understanding on calculation of moisture content of grain	2,4
12.	Methods of grain sampling under storage condition.		Gain understanding on Methods of grain sampling under storage condition.	2,3
13.	Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi.		Exposure visit to to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi	2,3
14.	Visit to nearest FCI godowns		Exposure visit to nearest FCI godowns	2,3

TEXT BOOKS:

T1: Prasad, T.V. 2019. Handbook of Entomology, Fourth Edition, New Vishal Publications, New Delhi.

REFERENCE BOOKS:

R1: Wafullah, N.T. 2020. Crop Pests and Stored Grain Pests and their Management, Arcler Education Inc

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand and manage diverse arthropod pests across crops.	1, 2, 4, 8, 12
2	Analyse life cycles of insect pests in agricultural settings.	1, 4, 7, 12
3	Evaluate factors affecting stored grain losses and apply management techniques.	1, 2, 3, 4, 6, 7, 8, 12
4	Identify and control pests associated with stored grain effectively.	1, 4, 7, 8, 12
5	Apply practical methods for assessing infestation, calculating doses, and managing storage structures.	1, 2, 3, 4, 5, 6, 7, 12

SEMESTER – V									
Course Title	**Diseases of Field and Horticultural Crops and their Management-I**								
Course Code	**23BSAG3104R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To identify and understand the symptoms, etiology, and disease cycles of major plant diseases affecting both field and horticultural crops. 2. To evaluate and develop integrated disease management strategies for controlling key pathogens in major crops, including cultural, chemical, and biological control methods. 3. To assess the impact of environmental and agronomic factors on the development and spread of diseases in field and horticultural crops.								
CO1	Comprehensive understanding of diseases in key grassy cereals like rice, maize, sorghum, and bajra, facilitating recognition, diagnosis, and management.								
CO2	Essential knowledge of prevalent diseases in oilseeds and pulses such as groundnut, soybean, pigeonpea, finger millet, black gram, green gram, castor, and tobacco, for effective identification and mitigation in agriculture.								
CO3	Valuable insight into diseases affecting fruit crops like guava, banana, papaya, and pomegranate, enabling identification, diagnosis, and implementation of suitable management strategies								
CO4	Acquiring crucial knowledge of prevalent diseases in cruciferous vegetables, Brinjal, tomato, okra, beans, ginger, and colocasia, for effective recognition, management, and mitigation in vegetable cultivation.								
CO5	Understanding prevalent diseases in coconut, tea, and coffee crops, allowing identification, diagnosis, and implementation of effective management strategies against wilt, bud rot, blister blight, and rust diseases.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Major Diseases of Field Crops (Rice, Maize, Sorghum, Bajra, Groundnut)** **Rice** Diseases: Blast, Brown Spot, Bacterial Blight, Sheath Blight, False Smut, Khaira, Tungro. Etiology, Symptoms, Disease Cycle, and Management Practices **Maize:** Diseases: Stalk Rots, Downy Mildew, Leaf Spots Etiology, Symptoms, Disease Cycle, and Management Practices **Sorghum:** Diseases: Smuts, Grain Mold, Anthracnose Etiology, Symptoms, Disease Cycle, and Management Practices **Bajra:** Diseases: Downy Mildew, Ergot Etiology, Symptoms, Disease Cycle, and Management Practices **Groundnut:** Diseases: Early and Late Leaf Spots, Wilt	**6**	Students will be able to identify and describe the major diseases affecting field crops such as rice, maize, sorghum, bajra, and groundnut. They will demonstrate an understanding of the etiology, symptoms, disease cycle, and management practices for each of the listed diseases, and apply this knowledge to develop effective disease management strategies for these crops.	1,2,3

	Etiology, Symptoms, Disease Cycle, and Management Practices			
II	**Major Diseases of Soybean, Pigeonpea, Finger Millet, Black & Green Gram** **Soybean** Diseases: Rhizoctonia Blight, Bacterial Spot, Seed and Seedling Rot, Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Pigeonpea** Diseases: Phytophthora Blight, Wilt, Sterility Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Finger Millet** Diseases: Blast, Leaf Spot Etiology, Symptoms, Disease Cycle, and Management Practices **Black & Green Gram** Diseases: Cercospora Leaf Spot, Anthracnose, Web Blight, Yellow Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices	**7**	Students will be able to identify, analyze, and describe the major diseases affecting soybean, pigeonpea, finger millet, black gram, and green gram crops. They will gain a deep understanding of the etiology, symptoms, disease cycle, and management practices for each disease, enabling them to effectively monitor, diagnose, and implement control measures for disease management in these crops.	2,3
III	**Major Diseases of Castor, Tobacco, and Horticultural Crops (Guava, Banana)** **Castor** Diseases: Phytophthora Blight Etiology, Symptoms, Disease Cycle, and Management Practices **Tobacco** Diseases: Black Shank, Black Root Rot, Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Guava** Diseases: Wilt, Anthracnose Etiology, Symptoms, Disease Cycle, and Management Practices **Banana** Diseases: Panama Wilt, Bacterial Wilt, Sigatoka, Bunchy Top Etiology, Symptoms, Disease Cycle, and Management Practices	**7**	Students will be able to identify and describe the major diseases affecting castor, tobacco, and horticultural crops (guava and banana), including their etiology, symptoms, disease cycle, and effective management practices for each disease, enabling them to develop strategies for disease prevention and control in agricultural settings.	2,3
IV	**Diseases of Papaya, Pomegranate, Cruciferous Vegetables, and Brinjal** **Papaya** Diseases: Foot Rot, Leaf Curl, Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Pomegranate** Disease: Bacterial Blight Etiology, Symptoms, Disease Cycle, and Management Practices **Cruciferous Vegetables** Diseases: Alternaria Leaf Spot, Black Rot Etiology, Symptoms, Disease Cycle, and Management Practices **Brinjal** Diseases: Phomopsis Blight, Fruit Rot, Sclerotinia Blight Etiology, Symptoms, Disease Cycle, and Management Practices	**7**	Students will be able to identify and describe the key diseases affecting Papaya (Foot Rot, Leaf Curl, Mosaic), Pomegranate (Bacterial Blight), Cruciferous Vegetables (Alternaria Leaf Spot, Black Rot), and Brinjal (Phomopsis Blight, Fruit Rot, Sclerotinia Blight), including their etiology, symptoms, disease cycle, and effective management practices to mitigate their impact on crop health.	1,2,3

V	Diseases of Tomato, Okra, Beans, Ginger, Colocasia, and Plantation Crops **Tomato** Diseases: Damping Off, Wilt, Early and Late Blight, Buckeye Rot, Leaf Curl, Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Okra** Disease: Yellow Vein Mosaic Etiology, Symptoms, Disease Cycle, and Management Practices **Beans** Diseases: Anthracnose, Bacterial Blight Etiology, Symptoms, Disease Cycle, and Management Practices **Ginger** Disease: Soft Rot Etiology, Symptoms, Disease Cycle, and Management Practices **Colocasia** Disease: Phytophthora Blight Etiology, Symptoms, Disease Cycle, and Management Practices Plantation Crops: **Coconut** Diseases: Wilt, Bud Rot Etiology, Symptoms, Disease Cycle, and Management Practices **Tea** Disease: Blister Blight Etiology, Symptoms, Disease Cycle, and Management Practices **Coffee** Disease: Rust Etiology, Symptoms, Disease Cycle, and Management Practices	**3**	Learners will be able to identify, describe, and analyze the etiology, symptoms, disease cycle, and effective management practices of common diseases affecting tomato, okra, beans, ginger, colocasia, and plantation crops (coconut, tea, and coffee), enabling them to implement informed disease control strategies in agricultural practices.	1,2,3
Practical				
1	Identification of diseases of field crops: symptoms and signs.	**30**	Students will be able to identify common diseases of field crops, recognize their key symptoms and signs, and differentiate between disease-causing pathogens to implement appropriate management strategies.	1,2,3
2	Identification of diseases of horticultural crops: symptoms and signs.		It will help to identify and differentiate the common symptoms and signs of diseases in horticultural crops, accurately diagnosing conditions based on visual clues and providing appropriate management recommendations.	1,2,3
3	Microscopic observation of pathogen structures (hyphae, spores, etc.) in diseased tissues.		It will help the learners to identify and differentiate various pathogen structures, such as hyphae and spores, in diseased tissues through microscopic observation, and describe their role in the pathogenesis of the disease.	1,2,3
4	Preparation of Herbarium Specimens: Step-by-step process of preparing and mounting specimens. Proper labeling and documentation of specimens. Organizing a plant disease herbarium for		Students will be able to properly collect, prepare, and mount herbarium specimens, ensuring that each specimen is accurately labeled and documented, with a focus on organizing a plant disease herbarium for educational and research purposes.	2,3,6

	educational and research purposes.			
5	Collection and Preservation of Diseased Plant Specimens Methods for collecting plant disease specimens. Best practices for specimen preservation for herbarium. Preservation techniques (drying, pressing, and mounting).		Students will be able to effectively collect and preserve diseased plant specimens using best practices for herbarium preparation, including appropriate methods of drying, pressing, and mounting, to ensure accurate long-term storage and study.	2,3,6
6	**Field Visit for Disease Diagnosis** Practical exposure to field conditions. Hands-on diagnosis of diseases in field crops and horticultural crops. Understanding environmental factors affecting disease development.		By the end of the field visit, students will be able to identify and diagnose common diseases in field and horticultural crops, while demonstrating an understanding of the environmental factors influencing disease development and their impact on crop health.	2,3

TEXT BOOKS:

1. Singh, R.S. 2017. Diseases of Vegetable crops. Medtech. R.S.

REFERENCE BOOKS:

1. Dutta, P., Tamuli, P., Kaushik, H. 2015. Crop Diseases and their Management Strategies. Aavishakar Publishers
2. Singh, R.S. 2024. Plant Diseases. 11th edition. Medtech Science Press.
3. Nene, Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control, 4th edition. Medtech/Generic

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Comprehensive understanding of diseases in key grassy cereals like rice, maize, sorghum, and bajra, facilitating recognition, diagnosis, and management.	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
2	Essential knowledge of prevalent diseases in oilseeds and pulses such as groundnut, soybean, pigeon pea, finger millet, black gram, green gram, castor, and tobacco, for effective identification and mitigation in agriculture.	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
3	Valuable insight into diseases affecting fruit crops like guava, banana, papaya, and pomegranate, enabling identification, diagnosis, and implementation of suitable management strategies	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
4	Acquiring crucial knowledge of prevalent diseases in cruciferous vegetables, brinjal, tomato, okra, beans, ginger, and colocasia, for effective recognition, management, and mitigation in vegetable cultivation.	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
5	Understanding prevalent diseases in coconut, tea, and coffee crops, allowing identification, diagnosis, and implementation of effective management strategies against wilt, bud rot, blister blight, and rust diseases.	1, 2, 3, 4, 6, 8, 9, 10, 11, 12

SEMESTER- V									
Course Title	**Crop Improvement- I (Kharif Crops)**								
Course Code	**23BSAG3105R**	**Total Credits: 2** **Total Hours: 15T + 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To provide a solid foundation in centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fibres, fodders and cash crops. 2. To provide a solid foundation in centers of origin, distribution of species, wild relatives in different vegetable and horticultural crops. 3. To impart knowledge on breeding objectives for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality.								
CO1	Understand the origin, distribution, and different breeding methods for various Kharif field and horticultural crops								
CO2	Acquire knowledge about plant genetic resources, centres of diversity and centres of diversity.								
CO3	Learn about breeding of self-pollinated, cross pollinated and vegetatively propagated crops.								
CO4	Gain knowledge on breeding for resistance to biotic and abiotic stresses and breeding for quality.								
CO5	Understand about ideotype, factors affecting ideotype breeding and hybrid seed production in various crops.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Centers of origin, distribution of species, wild relatives in different cereals, Centers of origin, distribution of species, wild relatives in different pulses, Centers of origin, distribution of species, wild relatives in different oilseeds, Centers of origin, distribution of species, wild relatives in different fodder crops, Centers of origin, distribution of species, wild relatives in different cash crops	**5**	Learn about centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fibres, fodders and cash crops.	1,2
II	Centers of origin, distribution of species, wild relatives in different vegetable crops, Centers of origin, distribution of species, wild relatives in horticultural crops	**2**	Learn about centers of origin, distribution of species, wild relatives in different vegetable and horticultural crops	1,2
III	Plant genetic resources, its utilization and conservation, Study of genetics of qualitative and quantitative characters	**2**	Learn about utilization and conservation of plant genetic resources.	1,2
IV	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability Major breeding objectives and procedures for abiotic stress tolerance Major breeding objectives and procedures for biotic stress tolerance Major breeding objectives and procedures for quality (physical, chemical, nutritional)	**4**	Learn about breeding for yield, adaptability, stability, abiotic and biotic stress tolerance and quality	2,3

V	Hybrid seed production technology maize, rice, sorghum, pearl millet and pigeonpea; Ideotype concept , Climate resilient crop varieties for future	**2**	Gain knowledge about ideotype, its importance and hybrid seed production technology of Kharif crops	2,3
Practical				
1.	Study floral biology of Rice, Jute, Maize	**30**	Floral biology, emasculation and hybridization techniques in different crop species namely Rice, Jute, Maize	2,3
2.	Study floral biology of Sorghum, Pearl millet, Ragi, Pigeonpea		Floral biology, emasculation and hybridization techniques in different crop species namely Sorghum, Pearl millet, Ragi, Pigeonpea	2,3
3.	Study floral biology of Urdbean, Mungbean, Soybean		Floral biology, emasculation and hybridization techniques in different crop species namely Urdbean, Mungbean, Soybean	2,3
4.	Study floral biology of Groundnut, Sesame		Floral biology, emasculation and hybridization techniques in different crop species namely Groundnut, Sesame	2,3
5.	Study floral biology of Castor, Cotton, Cowpea		Floral biology, emasculation and hybridization techniques in different crop species namely Castor, Cotton, Cowpea	2,3
6.	Study floral biology of Tobacco, Brinjal, Okra		Floral biology, emasculation and hybridization techniques in different crop species namely Tobacco, Brinjal, Okra	2,3
7.	Study floral biology of Cucurbitaceous crops		Floral biology, emasculation and hybridization techniques in Cucurbitaceous crops	2,3
8.	Learn about maintenance breeding of different kharif crops.		Maintenance breeding of different kharif crops.	1,2,3
9.	Learn about pedigree method		Handling of germplasm and segregating populations by different methods like pedigree method	2,3
10.	Learn about bulk method		Handling of germplasm and segregating populations by different methods like bulk method	2,3
11.	Learn about single seed descent		Handling of germplasm and segregating populations by different methods like single seed descent	2,3
12.	Learn about seed production in Kharif crops.		Study of field techniques for seed production and hybrid seeds production in Kharif crops	2,3
13.	Learn about heterosis, inbreeding depression and heritability.		Estimation of heterosis, inbreeding depression and heritability	1,2,3
14.	Learn about layout of field experiments		Layout of field experiments	2,3
15.	Learn about study of donor parents for different characters		Study of quality characters, study of donor parents for different characters	2,3

16.	Field visit to seed production plots		Visit to seed production plots	2,3
17.	Field visit to AICRP plots		Visit to AICRP plots of different field crops	2,3

TEXT BOOKS:

T1: Sharma, M.K., Bhuyan, J. and zaman,S. (2021). Crop Breeding Vol - I (Kharif Crops). Rudra Publications.

REFERENCE BOOKS:

R1: Allen, S.D. and Poehlman, J.M. 2006. Breeding Field Crops, Wiley

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the origin, distribution, and different breeding methods for various Kharif field and horticultural crops	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Acquire knowledge about plant genetic resources, centres of diversity and centres of diversity.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Learn about breeding of self-pollinated, cross pollinated and vegetatively propagated crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Gain knowledge on breeding for resistance to biotic and abiotic stresses and breeding for quality.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Understand about ideotype, factors affecting ideotype breeding and hybrid seed production in various crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – V									
Course Title	**Entrepreneurship Development and Business Communication**								
Course Code	**23BSAG3106R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. Equip students with essential entrepreneurial skills, including business planning, leadership, and problem-solving for successful venture creation and management. 2. Enhance understanding of agribusiness and rural development by exploring unique opportunities and challenges to drive innovation and economic growth in rural sectors. 3. Provide practical experience and networking opportunities with entrepreneurs and institutions, fostering real-world competencies and valuable professional connections.								
CO1	Evaluate personal entrepreneurial traits and skills to identify strengths and areas for growth in starting and managing a business.								
CO2	Develop comprehensive business plans and craft persuasive proposals to attract investors and stakeholders.								
CO3	Demonstrate leadership and organizational skills necessary for effectively managing and leading entrepreneurial ventures.								
CO4	Apply financial management techniques to ensure the sustainability and profitability of a business.								
CO5	Engage in experiential learning and industry-related activities to gain practical insights and build professional networks in entrepreneurship.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs. SWOT Analysis & achievement motivation. Government policy and programs and institutions for entrepreneurship development.	**4**	Evaluate personal entrepreneurial traits and skills to identify strengths and areas for growth in starting and managing a business.	1,2,5
II	Role of economic reforms *viz.* Agri-clinics, Agribusiness/Agri-enterprises, Entrepreneurial Development. Project Planning Formulation and report preparation	**2**	Develop comprehensive business plans and craft persuasive proposals to attract investors and stakeholders.	1,2,6
III	Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill.	**5**	Demonstrate leadership and organizational skills necessary for effectively managing and leading entrepreneurial ventures.	2,3
IV	Financing of enterprise, Supply chain management and Total quality management	**2**	Apply financial management techniques to ensure the sustainability and profitability of a business.	2,3
V	Opportunities for agri-entrepreneurship and rural enterprise. Extension administration: meaning and concept, principles and functions.	**2**	Engage in experiential learning and industry-related activities to gain practical insights and build	2,3

			professional networks in entrepreneurship.	
Practical				
1	Assessing entrepreneurial traits of entrepreneur.	**30**	Analyse and evaluate key entrepreneurial traits by applying assessment tools to real-world entrepreneurial scenarios.	2,3,4,5
2	Exercise on problem solving skills.		Apply problem-solving techniques to analyse, evaluate, and develop effective solutions for real-world challenges.	2,3,4,5
3	Exercise on managerial skills.		Demonstrate effective managerial skills by applying problem-solving, decision-making, and leadership techniques in practical scenarios.	2,3
4	Exercise on achievement motivation.		Analyse personal achievement motivation through practical exercises to enhance goal-setting and performance strategies.	2,3,4
5	Collection of traditional wisdom in agricultural field.		Analyse and apply traditional agricultural wisdom to enhance sustainable farming practices	2,3,4
6	Time audit through planning, monitoring and supervision (PERT).		Analyse and apply PERT techniques to effectively plan, monitor, and supervise project timelines for optimal time management.	2,3,4
7	Identification and selection of business idea.		Analyse and evaluate potential business opportunities to identify and select a viable business idea using structured decision-making processes	2,3,4,5
8	Preparation of business plan and proposal writing.		Develop and demonstrate the ability to analyse, design, and create comprehensive business plans and proposals, applying critical thinking and effective communication skills.	2,3
9	Exposure to entrepreneurship development institution (GDI, Gandhinagar) and Successful entrepreneurs (Input Dealers/Bio-pesticide/Vermi-compost).		Analyse and evaluate entrepreneurial strategies by engaging with entrepreneurship development institutions and successful agro-input entrepreneurs to develop practical insights into bio-pesticide and vermi-compost enterprises.	2,3,4
10	Exposure of NABARD, GFSC etc		Analyse the role and exposure of NABARD, GFSC, and similar financial institutions in agricultural and rural development, applying critical evaluation and problem-solving skills.	2,3,4

TEXT BOOKS:

T1: Kuratko, D.F. 2003. Entrepreneurship: Theory, Process, and Practice. South Western College Publishing.

T2: Longenecker, J.G., Petty, J.W., Palich, L.E. and Hoy, F. 2013. Small Business Management: Launching & Growing Entrepreneurial Ventures. South Western College Publishing

REFERENCE BOOKS:

R1: Mishra, P.K. Agri-Entrepreneurship: A Pathway for Sustainable Agricultural Development

R2: Indian Council of Agricultural Research. 2020. Handbook of Agricultural Extension.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Evaluate personal entrepreneurial traits and skills to identify strengths and areas for growth in starting and managing a business.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
2	Develop comprehensive business plans and craft persuasive proposals to attract investors and stakeholders.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
3	Demonstrate leadership and organizational skills necessary for effectively managing and leading entrepreneurial ventures.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
4	Apply financial management techniques to ensure the sustainability and profitability of a business.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
5	Engage in experiential learning and industry-related activities to gain practical insights and build professional networks in entrepreneurship.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Geo-informatics and Nanotechnology and Precision Farming**								
Course Code	**23BSAG3107R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To understand and apply the concepts and techniques of precision agriculture in the context of Indian agriculture, identifying key issues and concerns, and exploring the role of geo-informatics, including GIS, remote sensing, and GPS, in improving agricultural productivity. 2. To explore the use of geospatial technologies such as crop discrimination, yield monitoring, soil mapping, and fertilizer recommendations, and how these technologies contribute to sustainable and optimized agricultural practices. 3. To introduce and analyze the use of crop simulation models, STCR (Soil Test Crop Response) approach, and spatial data management in GIS, for optimizing agricultural inputs and enhancing farm management practices in precision agriculture.								
CO1	Master geospatial technologies for precision agriculture, including GIS, remote sensing, and GPS, for soil mapping and crop monitoring.								
CO2	Apply nanotechnology in agriculture for optimized inputs and enhanced productivity.								
CO3	Utilize GIS software for creating management zones and recommending fertilizers using VRT and STCR techniques.								
CO4	Interpret remote sensing images and conduct classifications for effective crop management.								
CO5	Design and execute precision farming projects integrating geospatial and nanotechnology for improved productivity and resource allocation.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Precision agriculture: concepts and techniques; their issues and concerns for Indian Agriculture; Geo-informatics - definition, concepts, tool and techniques; their use in Precision Agriculture	**4**	Define and describe the key concepts and techniques of precision agriculture, geo-informatics, remote sensing, and GIS, and explain their relevance and applications in Indian agriculture.	1,2
II	Crop discrimination and Yield monitoring, Soil mapping, Fertilizer recommendation using geospatial technologies	**2**	Apply geo-spatial technologies such as GPS, remote sensing, and GIS for crop discrimination, yield monitoring, soil mapping, and fertilizer recommendations in precision agriculture.	2,3
III	Spatial data and their management in GIS, Remote sensing concepts and application in agriculture	**3**	Analyse agricultural data and spatial information to assess soil health, crop performance, and optimize agricultural input management using geospatial tools.	2,3

IV	Image processing and interpretation, Global positioning system (GPS), components and its functions	**2**	Evaluate the effectiveness of different crop simulation models, the STCR approach, and the use of spatial data in optimizing agricultural productivity and sustainability in precision agriculture.	2,3,5
V	Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs, STCR approach for precision agriculture	**4**	Evaluate the effectiveness of different crop simulation models, the STCR approach, and the use of spatial data in optimizing agricultural productivity and sustainability in precision agriculture.	2,3,5
Practical				
1	Introduction to GIS software, spatial data creation and editing.	**30**	Demonstrate proficiency in using GIS software for spatial data creation, editing, and management, enabling accurate representation and analysis of geospatial information for agricultural applications.	2,3
2	Introduction to image processing software.		Demonstrate proficiency in using image processing software by applying basic techniques such as image enhancement, filtering, and interpretation for agricultural applications.	2,3
3	Visual and digital interpretation of remote sensing images.		Analyze and interpret remote sensing images using visual and digital techniques to extract meaningful agricultural and environmental information for precision farming applications.	2,3,4
4	Generation of spectral profiles of different objects.		Students will be able to generate and interpret spectral profiles of different objects, demonstrating an understanding of how spectral data can be used for object classification and analysis in remote sensing applications.	2,3
5	Projects formulation and execution related to precision farming.		Demonstrate the ability to formulate and execute projects related to precision farming, applying practical knowledge of advanced agricultural technologies and techniques to enhance farm productivity and sustainability	2,3

6	Supervised and unsupervised classification and acreage estimation.		Demonstrate the ability to apply supervised and unsupervised classification techniques for analysing agricultural data and accurately estimate crop acreage using remote sensing tools.	2,3
7	Multispectral remote sensing for soil mapping.		Students will be able to apply multispectral remote sensing techniques for soil mapping, analyse soil properties using spectral data, and interpret the results to support agricultural decision-making.	2,3,4
8	Creation of thematic layers of soil fertility based on GIS.		Students will be able to create and analyse thematic layers of soil fertility using GIS tools, demonstrating the ability to integrate spatial data for effective soil management and decision-making in precision agriculture.	2,3
9	Creation of productivity and management zones.		Students will be able to create productivity and management zones by analysing spatial data, applying geo-informatics techniques, and using precision agriculture tools to optimize resource allocation and enhance agricultural efficiency.	2,3,4
10	Fertilizers recommendations based of VRT and STCR techniques.		Demonstrate the ability to apply Variable Rate Technology (VRT) and Soil Test Crop Response (STCR) techniques to make precise fertilizer recommendations, optimizing crop yield and resource efficiency.	2,3
11	Crop stress (biotic/abiotic) monitoring using geospatial technology.		Demonstrate the ability to monitor and assess crop stress caused by biotic and abiotic factors using geospatial technologies, applying analytical skills to interpret spatial data for effective crop management.	2,3
12	Use of GPS for agricultural survey.		Students will demonstrate the ability to effectively use GPS technology for agricultural surveys, including accurate data collection, mapping, and analysis of agricultural land features.	2,3

13	Formulation, characterization and applications of Nano particles in agriculture		Students will be able to formulate, characterize, and analyse the applications of nanoparticles in agriculture, demonstrating an understanding of their potential uses in enhancing crop productivity and sustainability.	2,3,4

TEXT BOOKS:

T1: Reddy, S.R. 2023. Geoinformatics and Nanotechnology for Precision Farming, Amey Publication, Kalyani Publication, New Delhi

REFERENCE BOOKS:

R1: Kalhapure, A. A. 2020. Textbook of Geoinformatics and Nanotechnology for Precision Farming, Amey Publication. New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Master geospatial technologies for precision agriculture, including GIS, remote sensing, and GPS, for soil mapping and crop monitoring.	1, 2, 4, 5, 7, 8, 9, 10, 12
2	Apply nanotechnology in agriculture for optimized inputs and enhanced productivity.	1, 2, 4, 5, 7, 8, 10, 12
3	Utilize GIS software for creating management zones and recommending fertilizers using VRT and STCR techniques.	1, 2, 4, 5, 7, 8, 10
4	Interpret remote sensing images and conduct classifications for effective crop management.	1, 2, 4, 5, 7, 8, 10
5	Design and execute precision farming projects integrating geospatial and nanotechnology for improved productivity and resource allocation.	1, 2, 4, 5, 7, 8, 10

SEMESTER – V									
Course Title	**Practical Crop Production – I (Kharif Crops)**								
Course Code	**23BSAG3108R**	**Total Credits: 2** **Total Hours: 60P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. Understanding of crop planning and management practices 2. Proficiency in post-harvest handling and market management 3. Preparation of financial analysis and cost management								
CO1	Plan and decide on growing a suitable kharif crop.								
CO2	Decide on the best cropping system that can be allowed for a kharif season.								
CO3	Recommend package of practices for growing kharif crops.								
CO4	Practice kharif crop production through integrated management.								
CO5	Calculate cost benefit ratio based on cultivation and marketing expenses of crop.								

Unit-No		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1**	Crop planning and crop selection.	**60**	Students will learn about crop selection criteria and plan for optimal yield.	1,2
	2	Raising the kharif crops in multiple cropping system.		Students will learn the techniques for raising kharif crops in multiple cropping systems.	1,2
	3	Field preparation, seed treatment, nursery raising.		Students will understand techniques for field preparation, seed treatment, and nursery raising.	1,2
	4	Nutrient, water and weed management.		Students will learn about nutrient, water and weed management for sustainable agriculture.	1,2
	5	Pest and disease management.		Students will learn about pest control methods and disease prevention strategies for crops.	1,2,3
	6	Harvesting, threshing, drying, winnowing and storage.		Students will learn about the processes of harvesting, threshing, drying, winnowing and storage techniques.	2,3
	7	Seed production, mechanization, resource conservation.		Students will learn about seed production, mechanization and resource conservation techniques.	2,3
	8	Integrated Nutrient Management.		Students will learn how to enhance soil fertility and plant health through sustainable practices.	2,3
	9	Integrated Weed, Pest and disease management.		Students will understand and apply strategies for managing weeds, pests, and diseases in an integrated manner.	2,3
	10	Calculation of cost of Cultivation.		Students will learn to calculate the cost of cultivation for agricultural production.	2,3,4
	11	Net return per plot.		Students will learn how to calculate net return per plot for assessing agricultural profitability.	2,3,4

	12	B:C ratio estimation.		Students will learn how to estimate the benefit-to-cost ratio for decision-making and project evaluation.	2,3,4

TEXT BOOKS:

T1: Prasad, R. 2017. Field crop Production, Vol. 1 & Vol. 2 Food grain crops & Commercial crops, ICAR, New Delhi.

REFERENCE BOOKS:

R1: Reddy, S.R., Nagamani, C. 2022. Principles of Crop Production, Kalyani Publication, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Plan and decide on growing a suitable kharif crop.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Decide on the best cropping system that can be allowed for a kharif season.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Recommend package of practices for growing kharif crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Practice kharif crop production through integrated management.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Calculate cost benefit ratio based on cultivation and marketing expenses of crop.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER V									
Course Title	**Intellectual Property Rights**								
Course Code	**23BSAG3109R**	**Total Credits: 1** **Total Hours: 15T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To provide a solid foundation in Intellectual property rights, their types and importance. 2. To impart knowledge on different treaties. 3. To impart knowledge on organizations involved in the protection of intellectual property rights.								
CO1	Understand Intellectual property rights, their types and importance.								
CO2	Acquire knowledge of various organizations that promote the use and protection of intellectual property.								
CO3	Understand the various treaties involved in the protection of intellectual property rights.								
CO4	Gain knowledge on the process of patent filing, patent claims, patent opposition and revocation, patent search and patent database								
CO5	Understand the protection of plant varieties under different acts, their origin and history.								

Unit-No.	**Content**	**Contact Hours**	**Learning Outcome**	**KL**
I	Introduction and meaning of intellectual property Brief introduction to GATT, WTO, TRIPs and WIPO Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc	**3**	Learn about the meaning and importance of intellectual property and treaties for protection of intellectual property.	1,2
II	Types of Intellectual Property and legislations covering IPR in India: Patents, Copyrights, Trademark, Industrial design Geographical indications, Integrated circuits, Trade secrets.	**2**	Learn about different types of intellectual property.	1,2
III	Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims. Patent opposition and revocation, infringement, compulsory licensing Patent Cooperation Treaty, Patent search and patent database.	**3**	Learn about the process of filing patent and patent system in India.	1,2
IV	Origin and history including a brief introduction to UPOV for protection of plant varieties Protection of plant varieties under UPOV and PPV&FR Act of India Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001 Breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.	**4**	Learn about UPOV, PPV& amp; FR Act, breeders, researcher and farmers rights.	1,2

V	Convention on Biological Diversity International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing	**3**	Gain knowledge about the salient features of Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture and Indian Biological Diversity Act	1,2

TEXT BOOKS:

T1: Singh, P. 2009. IPR and Plant Breeders' Rights, New Vishal Publications

REFERENCE BOOKS:

R1: Singh, P. and Singh, R. 2008. IPR and Plant Breeders Rights at a Glance, New Vishal Publications.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1.	Understand Intellectual property rights, their types and importance.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2.	Acquire knowledge of various organizations that promote the use and protection of intellectual property.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3.	Understand the various treaties involved in the protection of intellectual property rights.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4.	Gain knowledge on the process of patent filing, patent claims, patent opposition and revocation, patent search and patent database	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5.	Understand the protection of plant varieties under different acts, their origin and history.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – V									
Course Title	**Landscaping**								
Course Code	**23BSAG3110R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. Learn the principles, styles, and components of landscaping, including various garden types and features. 2. Gain expertise in selecting, propagating, and managing trees, shrubs, climbers, perennials, and other garden plants for effective landscape design 3. Design and implement landscaping projects for urban and rural spaces using bio-aesthetic planning and CAD applications.								
CO1	Understand the importance, scope, and fundamental concepts of landscaping, including various garden styles and components.								
CO2	Create aesthetically appealing and sustainable landscape designs for residential, commercial, and public spaces.								
CO3	Identify and apply appropriate propagation, planting, and maintenance techniques for trees, shrubs, climbers, perennials, and other garden plants.								
CO4	Apply bio-aesthetic planning and eco-friendly landscaping techniques for urban and rural areas, including specialized spaces like schools, hospitals, and transport hubs.								
CO5	Use Computer-Aided Design (CAD) tools and contemporary methods to enhance landscape planning, visualization, and execution.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.	**8**	Understand the importance, principles, styles, and components of landscaping, including specialized gardens and structural features.	1,2
II	Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.	**6**	Learn the selection, propagation, and planning of planting of trees, shrubs, and herbaceous perennials, including canopy management and landscape architecture considerations.	1,2
III	Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management.	**5**	Understand the importance, selection, propagation, planting, and management of climbers, creepers, annuals, palms, ferns, grasses, cacti, succulents, and pot plants for effective landscaping.	1,2
IV	Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries,	**6**	Gain a clear understanding of bio-aesthetic planning, its importance, and its application in landscaping urban, rural, and peri-urban areas, including public spaces like schools, transport hubs, hospitals, and more.	2,3

	institutions.			
V	Bonsai: principles and management, lawn: establishment and maintenance. CAD application.	**5**	Learn about the principles and management of bonsai, lawn establishment and maintenance, and the application of CAD tools in landscape design.	2,3
Practical				
1	Identification of important vegetables	**30**	Identify important vegetables, propagate trees, shrubs, and annuals, manage plant care, potting, and repotting, recognize landscape tools, apply training and pruning techniques, establish and maintain lawns, design formal and informal gardens, create special garden types, design conservatories, and use computer software for landscape design, while also gaining practical insights through visits to gardens and institutes.	1,2,3
2	Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting			
3	Identification of tools and implements used in landscape design			
4.	Training and pruning of plants for special effects			
5.	Lawn establishment and maintenance			
6.	Layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden)			
7.	Designing of conservatory and lathe house			
8.	Use of computer software, visit to important gardens/ parks/ institutes			

TEXT BOOKS:

T1: Chandrashekar, S.K., Hemla, N.B. 2020. Principles of Landscape Gardening. ICAR.

T2: Kumar, A., Kumar, A. 2019. Text Book on Commercial Floriculture and Ornamental Horticulture with Landscape Architecture. Kalyani Publishers, Ludhiana

REFERENCE BOOKS:

R1: Mishra, R.L., Mishra, S. 2012. Landscape Gardening. Westville Publishing House.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the importance, scope, and fundamental concepts of landscaping, including various garden styles and components.	1,2,4,5,6,8,10,11,12
2	Create aesthetically appealing and sustainable landscape designs for residential, commercial, and public spaces.	1,2,4,5,6,10,11,12
3	Identify and apply appropriate propagation, planting, and maintenance techniques for trees, shrubs, climbers, perennials, and other garden plants.	1,2,5,6,8,11,12
4	Apply bio-aesthetic planning and eco-friendly landscaping techniques for urban and rural areas, including specialized spaces like schools, hospitals, and transport hubs.	1,2,3,4,5,6,10,11,12
5	Use Computer-Aided Design (CAD) tools and contemporary methods to enhance landscape planning, visualization, and execution.	1,2,4,5,7,8,11,12

SEMESTER – V									
Course Title	**Weed Management**								
Course Code	**23BSAG3110R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To introduce basic weed science and weeds. 2. To study about weed biology and ecology. 3. To study about principle of weed control.								
CO1	Gain knowledge on weeds affected ecosystems.								
CO2	Explain the mode of action of herbicides.								
CO3	Understand the role of allelochemical and the application of bioherbicides.								
CO4	Analyse herbicide compatibility and overcoming herbicide resistance.								
CO5	Recommend weed management strategies.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to weeds, Characteristics of weeds Beneficial and Harmful effect of weed Classification of weeds Reproduction and dissemination of weeds Crop- Weed Competition Critical period of Crop weed competition	**8**	Students will understand weeds characteristics, classification, reproduction and dissemination methods. They will learn both the beneficial and harmful effects of weeds, their competition with crops, and the critical period of crop-weed competition, enabling effective weed management strategies.	1,2
II	Herbicide Classification Concept of Adjuvant Concept of surfactant Herbicides formulation Herbicide selectivity Mode of action of herbicides	**6**	To learn about herbicide classification, adjuvants, surfactants, formulations, selectivity, and modes of action	2,3
III	Allelopathy – Concept Role of allelopathy in weed management Concept of Bioherbicides Role of Bioherbicides in weed management	**5**	Learn how allelopathy and bioherbicides naturally control weeds, reducing chemicals and enhancing sustainability	2,3
IV	Herbicide mixture and its utility Herbicides compatibility with another agro chemical, Herbicide Resistance, Herbicide Tolerance Management of Herbicide resistance and Herbicide tolerance	**6**	To learn about herbicide mixtures which enhance efficiency, compatibility with agrochemicals, prevent resistance, tolerance, and manage herbicide effectiveness.	2,3
V	Principles of weed control Cultural Methods of weed control Physical methods of weed control Biological methods of weed control, Chemical methods of weed control, Integrated Weed Management	**5**	To understand various weed control methods: cultural, physical, biological, chemical, and integrated approaches, optimizing effective management strategies.	2,3

Practical				
1	To study about techniques of weed preservation	**30**	To learn methods for effective weed preservation and storage techniques.	2,3
2	To identify various weed found in nearby area		To identify common weeds, their characteristics, and their environmental impact effectively.	1,2
3	To study about biology of weeds		To understand weed biology, growth patterns, impact, and control strategies.	2,3
4	To study about herbicide formulations		To learn about herbicide formulations, types, application methods, and their effectiveness.	2,3
5	To study about herbicide mixture		To learn about herbicide mixtures and their effects on plant control.	2,3
6	To study about herbicide and other agro-chemical		To understand the role of herbicides and agro-chemicals in agriculture.	2,3
7	To study about shift in weed flora		To understand the factors driving shifts in weed flora composition.	2,3
8	To study about methods of herbicide application		To learn about various herbicide application methods for effective weed control.	2,3
9	To study about various herbicide spraying equipment		To study about different herbicide spraying equipment and their applications.	2,3
10	Calculation of Herbicide doses		To learn how to calculate accurate herbicide doses for effective application.	2,3,4
11	Calculation of weed control efficiency and weed index		To know how to calculate weed control efficiency and determine weed index values effectively.	2,3,4

TEXT BOOKS:

T1: Das, T.K. Weed Science – Basic and Application, Jain Brothers, New Delhi.

REFERENCE BOOKS:

R1: Rao, V.S. Principles of Weed Science, CBS Publication, India.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Gain knowledge on weeds affected ecosystems.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Explain the mode of action of herbicides.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Understand the role of allelochemical and the application of bioherbicides.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Analyse herbicide compatibility and overcoming herbicide resistance.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Recommend weed management strategies.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER- V									
Course Title	**Commercial Plant Breeding**								
Course Code	**23BSAG3110R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To provide a solid foundation in commercial plant breeding, hybrid seed production in various crops and strategies for the development of lines and cultivars. 2. To impart knowledge on trials involved in variety release and notification 3. To impart knowledge on Intellectual property rights issues in commercial plant breeding.								
CO1	Acquire knowledge on testing of commercial hybrids for genetic purity.								
CO2	Understand development of lines in self and cross-pollinated crops								
CO3	Knowledge on hybrid seed production in various crops.								
CO4	Gain knowledge on the development of line and cultivars through biotechnological tools.								
CO5	Understand different types of trials involved in variety release and notification.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Types of crops and modes of plant reproduction, Line development and maintenance breeding in self-pollinated crops, Line development and maintenance breeding in cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids	**10**	Learn about modes of reproduction in plants and line development and maintenance breeding in self-pollinated and cross pollinated crops	1,2
II	Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton, pigeon pea, Brassica	**5**	Gather knowledge about advances in hybrid seed production of different crops.	1,2
III	Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques, biotechnological tools.	**5**	Learn about quality seed production of vegetable crops and alternative strategies for the development of the line and cultivars	2,3
IV	IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India.	**5**	Learn about Intellectual property rights issues in commercial plant breeding	1,2
V	Principles and techniques of seed production, types of seeds, Quality testing in self-pollinated and cross pollinated crops.	**5**	Gain knowledge about types of seeds and quality testing in self and cross pollinated crops	1,2

Practical				
1.	Floral biology in self and cross pollinated species, selfing and crossing techniques.		Learn floral biology in different self and cross pollinated species	2,3
2.	Techniques of seed production in self and cross pollinated crops using A/B/R and two line system.		Study techniques of seed production in self and cross pollinated crops	2,3
3.	Learning techniques in hybrid seed production using male-sterility in field crops.		Study techniques in hybrid seed production	2,3
4.	Understanding the difficulties in hybrid seed production		Learn about difficulties in hybrid seed production	2,3
5.	Tools and techniques for optimizing hybrid seed production.		Learn the tools and techniques for optimizing hybrid seed production	1,2
6.	Concept of rouging in seed production plot.		Study rouging in seed production plot.	2,3
7.	Concept of line, its multiplication and purification in hybrid seed production.		Learn about line, its multiplication and purification in hybrid seed production	2,3
8.	Role of pollinators in hybrid seed production.		Understand the role of pollinators in hybrid seed production	2,3
9.	Hybrid seed production techniques in sorghum		Study about hybrid seed production techniques in sorghum	2,3
10.	Hybrid seed production techniques in pearl millet	**30**	Study about hybrid seed production techniques in pearl millet	2,3
11.	Hybrid seed production techniques in maize		Study about hybrid seed production techniques in maize	2,3
12.	Hybrid seed production techniques in rice		Study about hybrid seed production techniques in rice	2,3
13.	Hybrid seed production techniques in rapeseed-mustard		Study about hybrid seed production techniques in rapeseed-mustard	2,3
14.	Hybrid seed production techniques in sunflower		Study about hybrid seed production techniques in sunflower	2,3
15.	Hybrid seed production techniques in castor		Study about hybrid seed production techniques in castor	2,3
16.	Hybrid seed production techniques in pigeon pea		Study about hybrid seed production techniques in pigeon pea	2,3
17.	Hybrid seed production techniques in cotton		Study about hybrid seed production techniques in cotton	2,3
18.	Hybrid seed production techniques in vegetable crops		Study about hybrid seed production techniques in vegetable crops	2,3

19.	Sampling and analytical procedures for purity testing and detection of spurious seed.		Learn about purity testing and detection of spurious seed.	2,3
20.	Seed drying and storage structure in quality seed management.		Learn about seed drying and storage	2,3
21.	Screening techniques during seed processing viz., grading and packaging.		Learn about seed processing	2,3
22.	Visit to public private seed production and processing plants.		Field visit to public private seed production and processing plants	2,3

TEXT BOOKS:

T1: Singh, P., Singh, M. and Billore, M. (2021). Commercial Plant Breeding Objective. Bio-Green Books

REFERENCE BOOKS:

R1 Singh, B.D. 2022. Plant Breeding: Principles and methods, Kalyani Publishers

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Acquire knowledge on testing of commercial hybrids for genetic purity.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Understand development of lines in self and cross-pollinated crops	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Knowledge on hybrid seed production in various crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Gain knowledge on the development of line and cultivars through biotechnological tools.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Understand different types of trials involved in variety release and notification.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – V									
Course Title	**Agri Business Management**								
Course Code	**23BSAG3110R**	**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**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/5th Semester of Third Year of the Programme**								
Course Objectives	1. To develop an understanding of agribusiness systems and their role in economic transformation. 2. To equip students with managerial and financial skills for effective agribusiness operations 3. To develop marketing and strategic decision-making capabilities in agribusiness								
CO1	Understand the Agribusiness System and its Role in the Economy								
CO2	Analyse Agribusiness Management Principles and Industry Dynamics								
CO3	Apply Strategic Management and Business Planning Techniques								
CO4	Demonstrate Financial and Marketing Management Skills								
CO5	Manage Agribusiness Projects and Value Chains Effectively								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy New Agricultural Policy. Distinctive features of Agribusiness Management	**3**	Students will understand the transformation of agriculture into agribusiness, the role of various stakeholders, and key components of agribusiness systems. They will also analyze the importance of agribusiness in the Indian economy, key aspects of the New Agricultural Policy, and the distinctive features of agribusiness management.	1,2
II	Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.	**3**	Students will understand the significance and necessity of agro-based industries, classify different types, and analyze the institutional procedures for setting them up. They will also identify key constraints in establishing agro-based industries and explore possible solutions.	1,2
III	Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.	**4**	The student will understand the meaning and concept of farm income, profitability, and the efficiency measures in both crop and livestock enterprises, emphasizing their role in farm business analysis. They will also grasp the meaning and significance of farm planning and budgeting, including partial and complete budgeting, and will apply linear programming techniques for optimal farm resource allocation and enterprise selection.	1,2

IV	Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis	**2**	Students will understand the key components of a business plan, the steps in planning and implementation, and the principles of organization, staffing, directing, and motivation. They will also gain knowledge of financial and capital management, financial statements, and essential marketing strategies, including segmentation, targeting, positioning, and consumer behavior analysis.	2,3
V	Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, Identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.	**3**	Students will understand the Product Life Cycle (PLC) and its impact on marketing strategies, along with the principles of Sales & Distribution Management and pricing policies. They will also gain insights into Project Management, including project cycles, appraisal, implementation, monitoring, and evaluation techniques for effective decision-making in agribusiness.	2,3
Practical				
1	Study of agri-input markets: Seed, fertilizers, pesticides.	**30**	Students will understand the structure and functioning of agri-input markets, including seeds, fertilizers, and pesticides. They will analyse market dynamics, distribution channels, and factors influencing demand and supply in the sector.	2,3,4
2	Study of output markets: grains, fruits, vegetables, flowers.		Students will understand the structure and functioning of output markets for grains, fruits, vegetables, and flowers. They will analyse market trends, pricing mechanisms, and factors influencing demand and supply in these agricultural markets.	3,4
3	Study of product markets, retails trade commodity trading, and value added products.		Students will understand the structure and functioning of product markets, retail trade, commodity trading, and the role of value-added products in agribusiness.	2,3
4	Study of financing institutions-Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD.		Students will understand the role, functions, and financial services of cooperative banks, commercial banks, RRBs, Agribusiness Finance Limited, and NABARD in supporting agribusiness enterprises.	2,3
5	Preparations of projects and Feasibility reports for agribusiness entrepreneur.		Students will develop the ability to prepare comprehensive project reports and feasibility studies for agribusiness ventures, assessing their viability and sustainability.	2,3

6	Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques.		Students will apply non-discounting methods like payback period, accounting rate of return (ARR), and profitability index for evaluating the financial viability of projects.	2,3
7	Case study of agro-based industries.		Students will critically analyse real-world examples of agro-based industries, identifying key success factors, challenges, and best practices for effective management and growth.	2,3
8	Trend and growth rate of prices of agricultural commodities.		Students will analyse the price trends and growth rates of agricultural commodities to understand market dynamics and forecast future price movements.	2,3
9	Net present worth technique for selection of viable project.		The students will evaluate financially viable projects by calculating and interpreting the net present value (NPV) of future cash flows.	2,3,5
10	Internal rate of return.		The students will learn to calculate and interpret IRR as a key financial metric for evaluating the profitability of investment projects.	2,3,4

TEXT BOOKS:

T1: Johl, S.S. and Kapur, J.R. 2006. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.

REFERENCE BOOKS:

R1: Subba Reddy, S., Raghu Ram, P., Sastry, TVN and Bhavani Devi, I. 2020. Agricultural Economics. Second Edition, CBS Publishers & Distributors.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the Agribusiness System and its Role in the Economy	1, 2, 3, 5, 6, 9, 10, 11
2	Analyse Agribusiness Management Principles and Industry Dynamics	1, 2, 5, 9, 10, 11, 12
3	Apply Strategic Management and Business Planning Techniques	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12
4	Demonstrate Financial and Marketing Management Skills	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Manage Agribusiness Projects and Value Chains Effectively	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Rainfed Agriculture & Watershed Management**								
Course Code	**23BSAG3201R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To understand rainfed agriculture and watershed management 2. To develop skills in soil, water conservation, and drought management 3. To learn about strategic planning and management in rainfed agriculture								
CO1	Build knowledge on solving problems related to rainfed agriculture.								
CO2	Identify several drought management strategies.								
CO3	Plan crop and water management approach to mitigate drought.								
CO4	Perceive the necessity and difficulties of watershed management.								
CO5	Recommend practices to be followed in rainfed farming system.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Rainfed Agriculture: Introduction, types, History of rainfed agriculture Problems and Prospect of rainfed agriculture in India Soil and climatic condition prevalent in rainfed areas Soil and Water conservation techniques	**4**	To understand rainfed agriculture's types, history, challenges, prospects, soil, climate and conservation techniques in India.	1,2
II	Drought – types Effect of water deficit in physio-morphological characteristics of the plants.	**2**	To understand the different types of drought and various physiological and morphological traits, emphasizing how water deficit affects plant growth, structure and survival mechanisms.	1,2
III	Crop adaptation and mitigation to drought Water harvesting: importance, its techniques	**2**	To understand crop adaptation strategies to drought and exploring water harvesting techniques to ensure agricultural sustainability.	2,3
IV	Efficient utilization of water through soil and crop management practices Management of crops in rainfed areas Contingent crop planning for aberrant weather conditions,	**3**	To understand the efficient water utilization through soil and crop management, optimizing crop growth in rainfed areas, and planning for contingencies during unpredictable weather conditions.	2,3
V	Watershed- concept, objective and principles Components of watershed management Problems in Watershed management	**4**	To understand watershed concepts, objectives, principles, management components, and challenges in effective management."	2,3

Practical				
1	To study about climate classification.	**30**	To study the different climatic zones and their characteristics	1,2
2	To study about rainfall pattern of India and Assam.		To study the rainfall patterns of India and Assam, including regional variations, seasonal changes, and factors influencing precipitation.	2,3
3	To study about pattern of onset and withdrawal of monsoon.		To study the timing, characteristic, and factors influencing the onset and withdrawal of the monsoon.	1,2
4	To study about cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.		To study the cropping patterns in rainfed areas and map their distribution in India.	2,3
5	To study about interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.		To study how meteorological data interpretation and evapotranspiration help schedule supplemental irrigation for crops efficiently.	2,3
6	To study about critical analysis of rainfall and possible drought period in the country		To study the rainfall patterns, assess impacts, and develop strategies for water resource management and disaster preparedness.	2,3
7	To study about effective rainfall and its calculation		To study the effective rainfall concepts and accurately calculate its impact on soil moisture.	2,3,4
8	To study about cultural practices for mitigating moisture stress.		To study the cultural practices that help mitigate moisture stress in agriculture.	2,3
9	To study about characterization and delineation of model watershed.		To study the process of characterization and delineation in watershed modelling for effective management.	2,3
10	To study about field demonstration of soil and moisture conservation measures		To study the techniques for improving soil fertility, conserving water and preventing erosion through hands-on experience and application of various conservation practices.	2,3,6
11	To study about field demonstration on construction of water harvesting structures		To study the process, techniques and benefits of constructing water harvesting structures through field demonstration.	2,3
12	Visit to rainfed research station		To provide insights into sustainable farming practices and water management techniques.	2,3

TEXT BOOKS:

T1: Jayadeva, H.M. and Ramachandrappa, B.K.2021. Rainfed Agriculture - Principle and Practices, New India Publication, India

REFERENCE BOOKS:

R1: Reddy, G.P. and Reddy, S.R. 2008. Dryland Agriculture, Agrotech Publishing Academy.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Build knowledge on solving problems related to rainfed agriculture.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Identify several drought management strategies.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Plan crop and water management approach to mitigate drought.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Perceive the necessity and difficulties of watershed management.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Recommend practices to be followed in rainfed farming system.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Protected Cultivation and Secondary Agriculture**								
Course Code	**23BSAG3202R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To provide fundamental knowledge of greenhouse technology, including types, design, construction materials, and environmental control for optimized plant growth. 2. To familiarize students with greenhouse irrigation systems, heating and cooling mechanisms, and cost estimation for economic feasibility. 3. To impart knowledge on post-harvest technology (PHT) by understanding the engineering properties of cereals, pulses, and oilseeds relevant to equipment design.								
CO1	Explain the principles of greenhouse technology, including design, environmental factors, and economic considerations.								
CO2	Analyse and evaluate greenhouse irrigation, heating, cooling, and drying systems for effective crop management.								
CO3	Apply engineering properties of agricultural produce in designing and operating post-harvest equipment.								
CO4	Demonstrate proficiency in moisture measurement techniques and operation of commercial drying equipment.								
CO5	Conduct field assessments of greenhouse structures, post-harvest processing units, and seed processing plants to gain practical exposure.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Green house technology, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses,	**2**	Study on greenhouse technology, their types and design of green house.	1,2
II	Design criteria of green house for cooling and heating purposes. Green house equipment's, materials of construction for traditional and low-cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, greenhouse drying.	**4**	Introduction to greenhouse design criteria, different irrigation method used in green house, solar green house and their application.	1,2,3
III	Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.	**4**	Study on cost estimation of greenhouse technology, engineering properties of cereals, pulses and equipment used in post-harvest technology.	2,3,4
IV	Introduction to Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flatbed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).	**3**	Introduction on drying and dehydration technology, moisture content, EMC, drying theory and different types of dryers.	2,3
V	Material handling equipment; conveyer and elevators, their principle, working and selection.	**2**	Study on various types of conveyors and elevator with their working and selection.	2,3

Practical				
1	Study of different type of greenhouses based on shape.		Study of different types of green house.	1,2
2	Determine the rate of air exchange in an active summer winter cooling system.		Estimation of air exchange rates in summer and winter.	1,2
3	Determination of drying rate of agricultural products inside green house.		Estimation of drying rate of agricultural products inside green house.	2,3,4
4.	Study of greenhouse equipment's.		Study on various equipment's used in green house.	1,3
5.	Visit to various Post Harvest Laboratories.		Field visit to different post-harvest industries.	2,3
6.	Determination of Moisture content of various grains by oven drying & infrared moisture methods.	**30**	Study on estimation of moisture content of grains by oven drying and infrared methods.	2,3
7.	Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).		Estimation of shape, size, bulk density and porosity of biomaterial used in green house technology and secondary agriculture.	2,3,4
8.	Determination of Moisture content of various grains by moisture meter.		Estimation of moisture content of various grains by moisture meter.	2,3,4
9.	Determination of drying kinetics of food product.		Study on drying kinetics of food products.	2,3
10.	Field visit to seed processing plant.		Visit to seed processing units.	2,3

TEXT BOOKS:

T1: Prabhakar, I. 2020. Protected Cultivation of Horticulture Crops. Satish serial Publishing House

T2: Sindhu, V., Ashok Kumar, B., Ramesh, E.. 2020. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops. Science Technology

REFERENCE BOOKS:

R1. Nelson, P.V. 2013. Greenhouse operation and management. Pearson.

R2. Jha, M.K., Paikra, S.S., S. and Sahu, M.R. 2019. Protected cultivation of Horticultural crops. Educreation Publishing.

R3. Singh, B. and Singh, B., Sabir, N. and Hasan, M. 2015. Advances in Protected Cultivation. NIPA, 252 pp.

R4: Maitra, S., Gaikwad, D.J. and Shankar, T. 2021. Protected Cultivation and Smart Agriculture. New Delhi Publishers, 263 pp.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Explain the principles of greenhouse technology, including design, environmental factors, and economic considerations.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
2	Analyse and evaluate greenhouse irrigation, heating, cooling, and drying systems for effective crop management.	1, 2, 3, 5, 6, 7, 9, 11, 12
3	Apply engineering properties of agricultural produce in designing and operating post-harvest equipment.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
4	Demonstrate proficiency in moisture measurement techniques and operation of commercial drying equipment.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
5	Conduct field assessments of greenhouse structures, post-harvest processing units, and seed processing plants to gain practical exposure.	1, 2, 3, 4, 5, 7, 8, 9, 11, 12

<table>
<tr><th colspan="10">SEMESTER – VI</th></tr>
<tr><td>Course Title</td><td colspan="9">Diseases of Field and Horticultural Crops and their Management-II</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">23BSAG3203R</td><td rowspan="2">Total Credits: 3
Total Hours: 30T+30P</td><td>L</td><td>T</td><td>P</td><td>S</td><td>R</td><td>O/F</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>0</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td>Co-requisite</td><td colspan="7">Nil</td></tr>
<tr><td>Programme</td><td colspan="9">B.Sc. (Hons.) Agriculture</td></tr>
<tr><td>Semester</td><td colspan="9">Spring/6th Semester of Third Year of the Programme</td></tr>
<tr><td>Course Objectives</td><td colspan="9">1. To equip students with comprehensive knowledge of the symptoms, etiology, and disease cycles of common plant diseases affecting field crops (wheat, sugarcane, sunflower, mustard, gram, lentil, cotton, and pea) and horticultural crops (mango, citrus, grapevine, apple, peach, strawberry, potato, cucurbits, onion, garlic, chillies, turmeric, coriander, marigold, and rose).
2. To enable students to learn the management of scab, fire blight, and crown gall in apples and peaches. Early and late blight in potato, leaf spot diseases in chillies, turmeric, and coriander. Disease-specific cultural, chemical, and biological control methods.
3. To provide students with an integrated approach to disease management across both field and horticultural crops, focusing on preventive, curative, and integrated strategies for sustainable crop protection on Preventive measures like crop rotation, resistant varieties, and proper cultural practices, curative treatments such as fungicides, bactericides, and biological agents, Integrated Disease Management (IDM) strategies combining chemical, biological, and cultural control. Case studies on the control of diseases like downy mildew, wilt, and powdery mildew in various crops</td></tr>
<tr><td>CO1</td><td colspan="9">Understanding Pathogen Identification and Disease Symptoms- To recognize and differentiate the symptoms and signs of various fungal, bacterial, and viral diseases affecting field and horticultural crops, including wheat (rusts, loose smut, karnal bunt, powdery mildew), sugarcane (red rot, smut, wilt), sunflower (Sclerotinia stem rot),</td></tr>
<tr><td>CO2</td><td colspan="9">Exploring Disease Etiology and Pathogenesis- To investigate the causative agents (fungi, bacteria, viruses) of common crop diseases and understand their role in disease development, including the disease cycle, environmental factors influencing spread, and host-pathogen interactions.</td></tr>
<tr><td>CO3</td><td colspan="9">Analyzing Disease Cycles in Field and Horticultural Crops- To describe the disease cycles of major crop diseases (e.g., rusts in wheat, red rot in sugarcane, and anthracnose in mango) and their impact on crop yield, health, and quality, including understanding their epidemiology and factors affecting disease outbreaks.</td></tr>
<tr><td>CO4</td><td colspan="9">Developing Integrated Disease Management Strategies- To formulate and apply effective disease management strategies (cultural, chemical, and biological control) for controlling fungal, bacterial, and viral diseases in crops, including alternative approaches for managing diseases like powdery mildew in cucurbits, wilt in gram, and rust in lentils.</td></tr>
<tr><td>CO5</td><td colspan="9">Practical Application of Disease Control in Horticultural Crops- To explore practical solutions for managing diseases in horticultural crops such as mango (anthracnose, malformation), citrus (canker), grapevine (downy mildew), and rose (powdery mildew), focusing on prevention, control measures, and best agricultural practices for minimizing disease impact.</td></tr>
</table>

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Wheat Diseases: Rusts (*Puccinia* species)**: Symptoms, etiology, disease cycle, and management. **Loose Smut (*Ustilago tritici*)**: Symptoms, etiology, disease cycle, and management. **Karnal Bunt (*Tilletia indica*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Blumeria graminis*)**: Symptoms, etiology, disease cycle, and management. **Alternaria Blight (*Alternaria* spp.)**: Symptoms, etiology, disease cycle, and management. **Ear Cockle (*Contortosporium heterostrophum*)**: Symptoms, etiology, disease cycle, and management. **Lentil Diseases: Rust (*Puccinia* spp.)**: Symptoms, etiology, disease cycle, and management. **Wilt (*Fusarium oxysporum*)**: Symptoms, etiology, disease cycle, and management. **Gram Diseases: Wilt (*Fusarium* spp.)**: Symptoms, etiology, disease cycle, and management. **Grey Mould (*Botrytis cinerea*)**: Symptoms, etiology, disease cycle, and management. **Ascochyta Blight (*Ascochyta rabiei*)**: Symptoms, etiology, disease cycle, and management	**6**	The learners will be able to identify and analyze the symptoms, etiology, disease cycles, and management strategies of key wheat, lentil, and gram diseases, including rusts, loose smut, Karnal bunt, powdery mildew, alternaria blight, ear cockle, wilt, grey mould, and ascochyta blight. Students will develop the ability to recommend appropriate disease management techniques based on an understanding of disease development and environmental factors affecting crop health.	2,3,4
II	**Sugarcane Diseases: Red Rot (*Colletotrichum falcatum*)**: Symptoms, etiology, disease cycle, and management. **Smut (*Ustilago scitaminea*)**: Symptoms, etiology, disease cycle, and management. **Wilt (*Fusarium* spp.)**: Symptoms, etiology, disease cycle, and management. **Grassy Shoot (*Sclerospora sacchari*)**: Symptoms, etiology, disease cycle, and management. **Ratoon Stunting Disease (*Leifsonia xyli* subsp. xyli)**: Symptoms, etiology, disease cycle, and management. **Pokkah Boeng (*Fusarium moniliforme*)**: Symptoms, etiology, disease cycle, and management. **Sunflower Diseases: Sclerotinia Stem Rot (*Sclerotinia sclerotiorum*)**: Symptoms, etiology, disease cycle, and management. **Alternaria Blight (*Alternaria helianthi*)**: Symptoms, etiology, disease cycle, and management.	**7**	Students will be able to **identify and describe the symptoms, etiology, disease cycles, and management strategies** for major sugarcane and sunflower diseases, including Red Rot, Smut, Wilt, Grassy Shoot, Ratoon Stunting Disease, Pokkah Boeng, Sclerotinia Stem Rot, and Alternaria Blight. Students will also develop the ability to apply integrated pest management practices to control these diseases effectively in agricultural systems.	1,2,3
III	**Mustard Diseases: Alternaria Blight (*Alternaria brassicae*)**: Symptoms, etiology, disease cycle, and management. **White Rust (*Albugo candida*)**: Symptoms, etiology, disease cycle, and management. **Downy Mildew (*Hyaloperonospora parasitica*)**: Symptoms, etiology, disease cycle, and management. **Sclerotinia Stem Rot (*Sclerotinia sclerotiorum*)**: Symptoms, etiology, disease cycle, and management.	**7**	Students will be able to identify key diseases affecting mustard, cotton, and pea crops, describe their symptoms, understand the etiology and disease cycle, and recommend appropriate management strategies for each disease,	1,2,3

	Cotton Diseases: Anthracnose (*Colletotrichum gossypii*): Symptoms, etiology, disease cycle, and management. **Vascular Wilt (*Fusarium oxysporum* f. sp. vasinfectum)**: Symptoms, etiology, disease cycle, and management. **Black Arm (*Alternaria* spp.)**: Symptoms, etiology, disease cycle, and management. **Pea Diseases: Downy Mildew (*Peronospora viciae*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Erysiphe pisi*)**: Symptoms, etiology, disease cycle, and management. **Rust (*Uromyces pisi*)**: Symptoms, etiology, disease cycle, and management.		including Alternaria Blight, White Rust, Downy Mildew, Sclerotinia Stem Rot, Anthracnose, Vascular Wilt, Black Arm, Powdery Mildew, and Rust.	
IV	**Mango Diseases: Anthracnose (*Colletotrichum gloeosporioides*)**: Symptoms, etiology, disease cycle, and management. **Malformation (*Fusarium* spp.)**: Symptoms, etiology, disease cycle, and management. **Bacterial Blight (*Xanthomonas campestris*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Oidium mangiferae*)**: Symptoms, etiology, disease cycle, and management. **Citrus Diseases: Canker (*Xanthomonas axonopodis*)**: Symptoms, etiology, disease cycle, and management. **Gummosis (*Phytophthora* species)**: Symptoms, etiology, disease cycle, and management. **Grape Vine Diseases: Downy Mildew (*Plasmopara viticola*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Uncinula necator*)**: Symptoms, etiology, disease cycle, and management. **Anthracnose (*Colletotrichum* spp.)**: Symptoms, etiology, disease cycle, and management. **Apple Diseases: Scab (*Venturia inaequalis*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Podosphaera leucotricha*)**: Symptoms, etiology, disease cycle, and management. **Fire Blight (*Erwinia amylovora*)**: Symptoms, etiology, disease cycle, and management. **Crown Gall (*Agrobacterium tumefaciens*)**: Symptoms, etiology, disease cycle, and management. **Peach Diseases: Leaf Curl (*Taphrina deformans*)**: Symptoms, etiology, disease cycle, and management. **Strawberry Disease: Leaf Spot (*Ramularia* spp.)**: Symptoms, etiology, disease cycle, and management. **Potato Diseases: Early Blight (*Alternaria solani*)**: Symptoms, etiology, disease cycle, and management. **Late Blight (*Phytophthora infestans*)**: Symptoms, etiology, disease cycle, and management. **Black Scurf (*Rhizoctonia solani*)**: Symptoms, etiology, disease cycle, and management. **Leaf Roll (Potato virus Y)**:	**7**	Students will be able to identify and describe the symptoms, etiology, disease cycle, and management strategies for various plant diseases, including those affecting mango, citrus, grapevines, apples, peaches, strawberries, and potatoes. They will demonstrate an understanding of the impact of these diseases on crop yield and quality, and apply appropriate control measures to mitigate disease spread and improve plant health in agricultural practices.	1,2,3

	Symptoms, etiology, disease cycle, and management. **Mosaic (Potato virus X)**: Symptoms, etiology, disease cycle, and management.			
V	**Cucurbit Diseases: Downy Mildew (*Pseudoperonospora cubensis*)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Sphaerotheca fuliginea*)**: Symptoms, etiology, disease cycle, and management. **Wilt (*Fusarium oxysporum*)**: Symptoms, etiology, disease cycle, and management. **Onion and Garlic Diseases: Purple Blotch (*Alternaria porri*)**: Symptoms, etiology, disease cycle, and management. **Stemphylium Blight (*Stemphylium vesicarium*)**: Symptoms, etiology, disease cycle, and management. **Chilli Diseases: Anthracnose (*Colletotrichum capsici*)**: Symptoms, etiology, disease cycle, and management. **Fruit Rot (*Fusarium* spp.)**: Symptoms, etiology, disease cycle, and management. **Wilt (*Fusarium oxysporum* f. sp. capsici)**: Symptoms, etiology, disease cycle, and management. **Leaf Curl (Begomovirus)**: Symptoms, etiology, disease cycle, and management. **Turmeric Disease: Leaf Spot (*Curvularia* spp.)**: Symptoms, etiology, disease cycle, and management. **Coriander Disease: Stem Gall (*Protomyces macrosporus*)**: Symptoms, etiology, disease cycle, and management. **Marigold Disease: Botrytis Blight (*Botrytis cinerea*)**: Symptoms, etiology, disease cycle, and management. **Rose Diseases: Dieback (*Diplodia* spp.)**: Symptoms, etiology, disease cycle, and management. **Powdery Mildew (*Sphaerotheca pannosa*)**: Symptoms, etiology, disease cycle, and management. **Black Leaf Spot (*Diplocarpon rosae*)**: Symptoms, etiology, disease cycle, and management.	**3**	It will help students to identify and describe the symptoms, etiology, disease cycle, and management strategies of various plant diseases affecting cucurbits, onions, garlic, chilies, turmeric, coriander, marigolds, and roses, with a particular focus on Downy Mildew, Powdery Mildew, Fusarium Wilt, Anthracnose, and other common fungal and viral infections, and apply this knowledge to develop effective disease management plans for these crops.	1,2,3
Practical				
1	Identification of diseases of field crops: symptoms and signs. Collect samples from infected plants and note symptoms (e.g., leaf spots, wilting, yellowing, etc.).	**30**	Students will be able to identify specific diseases such as rust, smut, and blight, and record the environmental conditions that contribute to disease development.	2,3
2	Identification of diseases of horticultural crops: symptoms and signs. Focus on diseases affecting fruit and vegetable crops like tomatoes, peppers, citrus, and grapes. Examine the plants for typical symptoms such as fungal spots,		Students will differentiate between fungal, bacterial, and viral diseases in horticultural crops, and classify diseases by type.	2,3

	powdery mildew, or bacterial soft rot.			
3	Histopathological Study of Diseased Plant Tissues. Learn to prepare histopathological slides to study tissue damage caused by pathogens. Collect diseased plant tissue samples, prepare thin sections, stain with appropriate dyes (e.g., safranin, fast green), and observe under a microscope.		It will help the learners to identify and differentiate various pathogen structures, such as hyphae and spores, in diseased tissues through microscopic observation, and describe their role in the pathogenesis of the disease.	2,3
4	Microscopic Examination of Fungal Pathogens- Identify common fungal pathogens affecting crops using microscopic examination. Collect fungal spores from diseased plant tissues, prepare slides, and observe under a compound microscope		Students will identify common fungal structures such as conidia, sporangia, and mycelium.	2,3
5	Bacterial Disease Diagnosis in Plants- Ooze test will be conducted. Teach students the characteristic symptoms and bacterial pathogens that affect plants. Collect samples of symptomatic plants, perform simple bacterial isolation techniques (e.g., streak plating on agar), and identify by colony morphology and Gram staining.		Students will differentiate between bacterial and fungal infections based on morphology and staining	2,3
6	Viral Disease Symptoms and Diagnosis- Identify plant viral diseases and understand their transmission. Observe and record symptoms like mosaic patterns, stunted growth, or leaf curling.		Students will recognize key viral diseases in field crops and horticultural crops, such as tobacco mosaic virus (TMV) and cucumber mosaic virus (CMV)	2,3
7	Collection and Preservation of Plant Disease Specimens- Teach students' proper methods for collecting and preserving plant specimens for herbarium use. Collect plant specimens showing symptoms of disease, press them using a plant press, dry them, and mount on herbarium sheets.		Students will submit well-pressed and mounted specimens for their herbarium, showcasing the range of diseases they've studied.	2,3,6
8	Field Visit to Diagnose and Report Plant Disease Problems- Participate in a guided field visit to a farm or horticultural garden and diagnose plant diseases based on field symptoms.		Students will demonstrate practical skills in diagnosing plant health issues based on field observations and apply theoretical knowledge in real-world scenarios.	2,3

TEXT BOOKS:

1. Singh, R.S. 2017. Diseases of Vegetable crops. Medtech. R.S.

REFERENCE BOOKS:

1. Dutta, P., Tamuli, P., Kaushik, H. 2015. Crop Diseases and their Management Strategies. Aavishakar Publishers
2. Singh, R.S. 2024. Plant Diseases. 11th edition. Medtech Science Press.
3. Nene, Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control, 4th edition. Medtech/Generic

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understanding Pathogen Identification and Disease Symptoms- To recognize and differentiate the symptoms and signs of various fungal, bacterial, and viral diseases affecting field and horticultural crops, including wheat (rusts, loose smut, karnal bunt, powdery mildew), sugarcane (red rot, smut, wilt), sunflower (Sclerotinia stem rot).	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
2	Exploring Disease Etiology and Pathogenesis- To investigate the causative agents (fungi, bacteria, viruses) of common crop diseases and understand their role in disease development, including the disease cycle, environmental factors influencing spread, and host-pathogen interactions.	1, 2, 3, 6, 8, 10, 11, 12
3	Analysing Disease Cycles in Field and Horticultural Crops- To describe the disease cycles of major crop diseases (e.g., rusts in wheat, red rot in sugarcane, and anthracnose in mango) and their impact on crop yield, health, and quality, including understanding their epidemiology and factors affecting disease outbreaks.	1, 2, 3, 6, 8, 10, 11, 12
4	Developing Integrated Disease Management Strategies- To formulate and apply effective disease management strategies (cultural, chemical, and biological control) for controlling fungal, bacterial, and viral diseases in crops, including alternative approaches for managing diseases like powdery mildew in cucurbits, wilt in gram, and rust in lentils.	1, 2, 3, 4, 6, 8, 9, 10, 11, 12
5	Practical Application of Disease Control in Horticultural Crops- To explore practical solutions for managing diseases in horticultural crops such as mango (anthracnose, malformation), citrus (canker), grapevine (downy mildew), and rose (powdery mildew), focusing on prevention, control measures, and best agricultural practices for minimizing disease impact.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Post-Harvest Management and Value Addition of Fruits and Vegetables**								
Course Code	**23BSAG3204R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. Understand the principles and factors influencing post-harvest handling, including the causes of losses and the impact of maturity, ripening, and storage conditions on product quality. 2. Explore various preservation and value addition methods, including fermentation, drying, canning, and the production of intermediate moisture foods like jams and tomato products 3. Evaluate the effects of different processing techniques on the quality and standards of fruits and vegetables, ensuring optimal outcomes in preservation and storage.								
CO1	Demonstrate the importance of post-harvest management of fruits and vegetables								
CO2	Manage post-harvest quality through understanding maturity, ripening, and pre-harvest factors.								
CO3	Apply post-harvest processing principles to minimize losses and enhance fruit and vegetable quality.								
CO4	Utilize preservation techniques effectively to extend shelf life and add value to produce.								
CO5	Formulate and describe range of value-added products meeting industry standards								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening	**3**	Understand the importance, of post-harvest processing, the extent and causes of post-harvest losses, and how pre-harvest factors such as quality, maturity, and ripening influence the post-harvest characteristics of fruits and vegetables	1,2
II	Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric)	**3**	Understand the role of respiration in post-harvest quality, the factors influencing respiration rate, best practices for harvesting and field handling, and the principles of different storage methods, including ZECC, cold storage, CA, MA, and hypobaric storage, to extend shelf life and maintain produce quality.	2,3
III	Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards	**3**	Understand the concept of value addition, the principles and methods of preservation, and the production of intermediate moisture foods such as jam, jelly, marmalade, preserves,	2,3

			and candy, while adhering to established standards.	
IV	Fermented and non-fermented beverages. Tomato products- Concepts and Standards	**3**	Acquire knowledge of the production processes, quality standards, and preservation methods for fermented and non-fermented beverages, as well as various tomato products.	2,3
V	Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning –– Concepts and Standards, packaging of products	**3**	Understand the concepts, methods, and standards of drying, dehydration, osmotic drying, and canning of fruits and vegetables, along with appropriate packaging techniques to ensure product quality and shelf-life extension.	2,3
Practical				
1	Applications of different types of packaging, containers for shelf-life extension	**30**	Apply various packaging techniques, assess temperature effects on shelf life, demonstrate chilling and freezing injuries, prepare and preserve fruit products such as jams, juices, and canned goods, and evaluate product quality using physico-chemical and sensory methods.	2,3
2	Effect of temperature on shelf life and quality of produce			
3	Demonstration of chilling and freezing injury in vegetables and fruits			
4.	Extraction and preservation of pulps and juices			
5.	Preparation of jam, jelly, RTS, nectar, squash			
6.	Preparation of osmotically dried products, fruit bar and candy			
7.	Preparation of tomato products, canned products			
8.	Quality evaluation of products -- physico-chemical and sensory			
9.	Visit to processing unit/ industry.			

TEXT BOOKS:

T1: John, P.J. 2012. A Handbook on Post Harvest Management of Fruits and Vegetables. Daya Publishing House.

REFERENCE BOOKS:

R1: Rajput, M.S., Singh, D.K., Bishnoi, V.K. Post-Harvest Management and Value Addition. Rama Publishing House.

R2. Srivastava, R.P. and Kumar, S. 2019. Fruit and Vegetable Preservation: Principles & Practices. CBS Publishers & Distributors

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Demonstrate the importance of post-harvest management of fruits and vegetables	1, 2, 3, 4, 5, 6, 8, 11, 12
2	Manage post-harvest quality through understanding maturity, ripening, and pre-harvest factors.	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12
3	Apply post-harvest processing principles to minimize losses and enhance fruit and vegetable quality.	1, 2, 4, 5, 6, 8, 9, 10, 11, 12
4	Utilize preservation techniques effectively to extend shelf life and add value to produce.	1, 2, 3, 4, 5, 6, 10, 11, 12
5	Formulate and describe range of value-added products meeting industry standards	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Management of Beneficial Insects**								
Course Code	**23BSAG3205R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. The course offers a comprehensive exploration of beneficial insects, primarily honey bees, covering their biology, beekeeping methods, and pest management. 2. Practical sessions focus on silkworm rearing, mulberry cultivation, and lac insect identification. 3. Students also learn about biological pest control using natural enemies and engage in experiential learning through research institution visits. Ultimately, the course equips students with the skills for sustainable practices in beekeeping, sericulture, and pest management.								
CO1	Understand and apply principles of beneficial insect importance, bee biology, and beekeeping practices, including seasonal management and disease recognition.								
CO2	Demonstrate proficiency in silkworm rearing, mulberry cultivation, and pest management techniques.								
CO3	Recognize and assess lac insect species, their biology, and lac production methods.								
CO4	Identify and manage natural enemies of pests, such as predators and parasitoids, for effective biological control.								
CO5	Apply knowledge gained through practical experiences, including visits to research institutions, in understanding and implementing sustainable beekeeping, sericulture, lac culture, and pest management practices.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Importance of beneficial Insects,	**1**	Learners will comprehend the ecological importance of beneficial insects in maintaining biodiversity, soil health, and ecosystem balance.	1,2
II	Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants	**5**	Students will be able to explain the basic principles of beekeeping, including the roles of the beekeeper, hive management, and the equipment used for maintaining bee colonies. Learners will gain an understanding of the biology of honeybees (e.g., colony structure, lifecycle, communication methods like the waggle dance) and their behavioural patterns in the hive. Students will recognize the vital role of bees as pollinators in both natural ecosystems and agriculture.	2,3
III	Types of silk worm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm,	**5**	Students will be able to explain the fundamental processes of silkworm rearing, including the lifecycle of silkworms, the stages from egg to adult, and the significance of each stage in the production of silk. Students will gain knowledge about the different developmental stages of silkworms (egg,	2,3

	management, rearing appliances of mulberry silkworm and methods of disinfection.		larvae, pupa, and adult), and how to properly manage each stage to optimize silk production. Students will become familiar with common diseases and pests that affect silkworms, such as fungal infections, bacterial diseases, and predators like ants or mites.	
IV	Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.	**2**	Students will be able to explain the fundamental processes of lac rearing, including the lifecycle of lac insects, the stages of lac production, the biology of the lac insect (e.g., *Kerria lacca*), including its feeding habits, life cycle, and the secretion process that produces the resin (lac). Students will learn how to properly harvest lac from trees and how to process it into usable products. This includes techniques for removing lac from branches, cleaning, and refining it to produce products like shellac, which is used in coatings, varnishes, and cosmetics. The class will cover methods for managing lac insect colonies, ensuring healthy populations, and preventing pest infestations or diseases that could reduce production.	2,3
V	Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.	**2**	Students will be able to identify and explain the role of insect predators (e.g., ladybugs, lacewing larvae) and parasitoids (e.g., parasitic wasps) in controlling pest populations naturally. Learners will understand how these insects contribute to integrated pest management (IPM) and their significance in reducing the need for chemical pesticides. Students will learn various techniques for mass-rearing or mass multiplication of insect predators and parasitoids, which are crucial for large-scale pest control applications. Students will be able to identify key species of pollinators, insect species that contribute to natural weed control, scavengers, how to implement biological control strategies using beneficial insects, understanding their advantages over chemical methods in terms of sustainability, environmental impact, and long-term pest management.	2,3
Practical				
1	Honey bee species, castes of bees.	**30**	Study on various species of honey bees, identification of different castes present in the honey bees.	1,2
2	Beekeeping appliances and seasonal management, bee enemies and disease. Bee		Students will gain practical experience in identifying and using essential beekeeping tools and appliances, such as hives (Langstroth, Top Bar), smokers, hive	1,2,3

	pasturage, bee foraging and communication.		tools, protective gear (suits, gloves, veils), and frames. Students will gain practical skills in identifying common bee enemies and recognize symptoms of diseases like **American Foulbrood** (AFB), **European Foulbrood** (EFB), **Nosema**, and other bacterial, viral, and fungal infections that can affect bee colonies. Learners will practice identifying and evaluating local landscapes for potential foraging areas as well as engage in practical activities, such as planning or planting bee-friendly crops or flowering plants to enhance foraging opportunities in apiaries and surrounding areas. Students will gain hands-on experience in conducting thorough hive inspections to assess colony health, food stores, brood patterns, queen presence, and general hive conditions.	
3	Types of silkworm, voltinism and biology of silkworm.		Students will have hands-on experience with the biology of silkworms, including their identification, rearing, and care through different life stages. They will also understand voltinism and its impact on sericulture practices, as well as how to manage silkworm growth, feeding, and cocoon harvesting to ensure quality silk production.	1,2,6
4.	Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves		Students will be able to effectively manage mulberry cultivation, identify and select appropriate varieties for silkworm feeding, and apply harvesting and preservation methods to maintain a consistent and high-quality leaf supply. They will also gain skills in sustainable mulberry farming practices that can improve productivity and support silkworm rearing.	2,3,6
5.	Species of lac insect, host plant identification.		Students will have developed the skills to identify and manage both lac insect species and their host plants. They will understand the lifecycle of lac insects, their symbiotic relationship with plants, and how to maintain productive lac farms. The class will also provide practical insights into sustainable lac cultivation, harvesting techniques, and the role of lac in economic activities.	2,3,6
6.	Identification of other important pollinators, weed killers and scavengers.		Students will be equipped with the skills to identify and understand the behaviour of various pollinators, weed-killers, and scavengers, and appreciate their importance in ecosystem functioning and sustainable agriculture. They will also gain practical knowledge on how to promote and conserve these species in	1,2,3

			both natural and agricultural environments.	
7.	Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.		Exposure visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies so that they can practically gain insights into the topics	2,3
8.	Identification and techniques for mass multiplication of natural enemies		Students will have developed the skills necessary to identify natural enemies, understand their biology, and apply techniques for their mass multiplication. They will be able to set up rearing systems, monitor natural enemy effectiveness, and apply biological control methods in pest management, contributing to more sustainable and environmentally-friendly agricultural practices.	1,2,3

TEXT BOOKS:

T1: Prasad, T.V. 2020. Handbook of Entomology, Fourth Edition, New Vishal Publications, New Delhi.

REFERENCE BOOKS:

R1: Koshariya, K.A., Jadhav, M.S. and Ashok, A.N. 2021 Management of Beneficial Insects. Iterative International Publisher IIP.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand and apply principles of beneficial insect importance, bee biology, and beekeeping practices, including seasonal management and disease recognition.	1, 2, 3, 4, 5, 12
2	Demonstrate proficiency in silkworm rearing, mulberry cultivation, and pest management techniques.	1, 2, 3, 4, 5, 6, 7, 12
3	Recognize and assess lac insect species, their biology, and lac production methods.	1, 2, 3, 4, 5, 6, 10, 12
4	Identify and manage natural enemies of pests, such as predators and parasitoids, for effective biological control.	1, 2, 3, 4, 5, 6, 8, 12
5	Apply knowledge gained through practical experiences, including visits to research institutions, in understanding and implementing sustainable beekeeping, sericulture, lac culture, and pest management practices.	1, 2, 3, 4, 5, 6, 7, 8, 10, 12

SEMESTER- VI									
Course Title	**Crop Improvement-II (Rabi Crops)**								
Course Code	**23BSAG3206R**	**Total Credits: 2** **Total Hours: 15T + 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To provide a solid foundation in centers of origin, distribution of species, wild relatives in different Rabi cereals, pulses, oilseeds, fibres, fodders and cash crops. 2. To provide a solid foundation in centers of origin, distribution of species, wild relatives in different Rabi vegetable and horticultural crops. 3. To impart knowledge on breeding objectives for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality.								
CO1	Acquire knowledge on the origin, distribution, and wild relatives for various Rabi field and horticultural crops								
CO2	Acquire knowledge about conservation and utilization of plant genetic resources								
CO3	Learn about various qualitative and quantitative characters, their characteristics and the factors affecting them.								
CO4	Understand breeding objectives and procedures for development of hybrids and varieties.								
CO5	Gain knowledge about hybrid seed production in Rabi crops and ideotype breeding.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Centers of origin, distribution of species, wild relatives in different cereals, Centers of origin, distribution of species, wild relatives in different pulses, Centers of origin, distribution of species, wild relatives in different oilseeds, Centers of origin, distribution of species, wild relatives in different fodder crops, Centers of origin, distribution of species, wild relatives in different cash crops	**5**	Learn about centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fibres, fodders and cash crops.	1,2
II	Centers of origin, distribution of species, wild relatives in different vegetable crops, Centers of origin, distribution of species, wild relatives in horticultural crops	**2**	Learn about centers of origin, distribution of species, wild relatives in different vegetable and horticultural crops	1,2
III	Plant genetic resources, its utilization and conservation, Study of genetics of qualitative and quantitative characters	**2**	Learn about utilization and conservation of plant genetic resources.	1,2
IV	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, Major breeding objectives and procedures for abiotic stress tolerance, Major breeding objectives and procedures for biotic stress tolerance, Major breeding objectives and procedures for quality (physical, chemical, nutritional)	**4**	Learn about breeding for yield, adaptability, stability, abiotic and biotic stress tolerance and quality	1,2
V	Hybrid seed production technology of rabi crops, Ideotype concept, Climate resilient crop varieties for future	**2**	Gain knowledge about ideotype, its importance and hybrid seed production technology of rabi crops	1,2

Practical				
1.	Study floral biology of Wheat, Oat, Barley, Chickpea	**30**	Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea	1,2,3
2.	Study floral biology of Lentil, Field pea, Rajma, Horse gram		Floral biology, emasculation and hybridization. Techniques in different crop species namely Lentil, Field pea, Rajma, Horse gram	1,2,3
3.	Study floral biology of Rapeseed Mustard		Floral biology, emasculation and hybridization. Techniques in different crop species namely Rapeseed Mustard	1,2,3
4.	Study floral biology of Sunflower, Safflower		Floral biology, emasculation and hybridization. Techniques in different crop species namely Sunflower, Safflower	1,2,3
5.	Study floral biology of Potato, Berseem.		Floral biology, emasculation and hybridization techniques in different crop species namely Potato, Berseem.	1,2,3
6.	Study floral biology of Sugarcane, Tomato		Floral biology, emasculation and hybridization techniques in different crop species namely Sugarcane, Tomato	1,2,3
7.	Study floral biology of Chilli, Onion		Floral biology, emasculation and hybridization. Techniques in different crop species namely Chilli, Onion.	1,2,3
8.	Learn about pedigree method		Handling of germplasm and segregating populations by different methods like pedigree methods	2,3
9.	Learn about bulk method		Handling of germplasm and segregating populations by different methods like bulk method	2,3

10.	Learn about single seed descent		Handling of germplasm and segregating populations by different methods like single seed descent	2,3
11.	Learn about seed production in Rabi crops.		Study of field techniques for seed production and hybrid seeds production in Rabi crops	2,3
12.	Learn about heterosis, inbreeding depression and heritability.		Estimation of heterosis, inbreeding depression and heritability	2,3
13.	Learn about layout of field experiments		Layout of field experiments	2,3
14.	Learn about study of donor parents for different characters		Study of quality characters, study of donor parents for different characters.	1,2
15.	Field visit to seed production plots		Visit to seed production plots	2,3
16.	Field visit to AICRP plots		Visit to AICRP plots of different field crops	2,3

TEXT BOOKS:

T1: Ingole, D.G., Vitnor, S.S. and Bharade, V.M. (2020) Crop Improvement-II (Rabi Crops). AkiNik Publications.

REFERENCE BOOKS:

R1: Allen, S.D. and Poehlman, J.M. 2006. Breeding Field Crops. Wiley.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Acquire knowledge on the origin, distribution, and wild relatives for various Rabi field and horticultural crops	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Acquire knowledge about conservation and utilization of plant genetic resources	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Learn about various qualitative and quantitative characters, their characteristics and the factors affecting them.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Understand breeding objectives and procedures for development of hybrids and varieties.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Gain knowledge about hybrid seed production in Rabi crops and ideotype breeding.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Practical Crop Production – II (Rabi Crops)**								
Course Code	**23BSAG3207R**	**Total Credits: 2** **Total Hours: 60P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. Understanding of crop planning and management practices 2. Proficiency in post-harvest handling and market management 3. Preparation of financial analysis and cost management								
CO1	Plan and decide on growing a suitable rabi crop.								
CO2	Decide on the best cropping system that can be allowed for a rabi season.								
CO3	Recommend package of practices for growing rabi crops.								
CO4	Practice rabi crop production through integrated management.								
CO5	Calculate cost benefit ratio based on cultivation and marketing expenses of crop.								

Unit-No		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1**	Crop Planning and Crop selection.	**60**	Students will learn about crop selection criteria and plan for optimal yield.	1,2,3
	2	Raising the rabi crops in multiple cropping system.		Students will learn the techniques for raising rabi crops in multiple cropping systems.	2,3
	3	Field preparation, seed treatment, nursery raising.		Students will understand techniques for field preparation, seed treatment, and nursery raising.	2,3
	4	Nutrient, water and weed management.		Students will learn about nutrient, water and weed management for sustainable agriculture.	2,3
	5	Pest and disease management.		Students will learn about pest control methods and disease prevention strategies for crops.	2,3
	6	Harvesting, threshing, drying, winnowing and storage.		Students will learn about the processes of harvesting, threshing, drying, winnowing and storage techniques.	2,3
	7	Seed production, mechanization, resource conservation.		Students will learn about seed production, mechanization and resource conservation techniques.	2,3
	8	Integrated Nutrient Management.		Students will learn how to enhance soil fertility and plant health through sustainable practices.	2,3
	9	Integrated Weed, Pest and disease management.		Students will understand and apply strategies for managing weeds, pests, and diseases in an integrated manner.	2,3
	10	Calculation of cost of Cultivation.		Students will learn to calculate the cost of cultivation for agricultural production.	2,3,4
	11	Net return per plot.		Students will learn how to calculate net return per plot for assessing agricultural profitability.	2,3,4
	12	B:C ratio estimation.		Students will learn how to estimate the benefit-to-cost ratio for decision-making and project evaluation.	2,3,4

TEXT BOOKS:

T1: Prasad, R. Field crop production, Vol. 1 & Food grain crops & commercial crops, Vol. 2. ICAR, New Delhi

REFERENCE BOOKS:

R1: Reddy, S.R., Nagamani, C. Principles of Crop Production, Kalyani Publication, New Delhi

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Plan and decide on growing a suitable rabi crop.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Decide on the best cropping system that can be allowed for a rabi season.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Recommend package of practices for growing rabi crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Practice rabi crop production through integrated management.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Calculate cost benefit ratio based on cultivation and marketing expenses of crop.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI										
Course Title	**Principles of Organic Farming**									
Course Code	**23BSAG3208R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To understand organic farming principles and ecosystem 2. To know organic farming practices and regulatory framework 3. To study economic viability and market potential of organic products								
CO1	Building knowledge on principle of organic farming and initiatives taken by government for its promotion.								
CO2	Understanding organic ecosystem and resources.								
CO3	Decide on suitable crop and varieties in organic farming.								
CO4	Recommend organic crop management techniques.								
CO5	Recognize the process of organic seed certification.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Organic farming – principles and its scope in India. Initiatives taken by government of India for promotion of organic farming. Initiatives taken by NGOs and other organization for promotion of organic farming.	**4**	The students will learn about organic farming principles, its scope in India, and key initiatives by the government, NGOs, and organizations to promote it.	1,2
II	Organic ecosystem and their concepts Organic nutrient resources and its fortification	**2**	The students will learn about organic ecosystems, their concepts, nutrient resources, and fortification methods to enhance soil fertility and sustainability.	1,2
III	Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming;	**2**	The students will understand how nutrient restrictions and crop variety selection impact organic farming practices, productivity, and sustainability.	2,3
IV	Organic nutrient management Organic weed management Organic pest and disease management	**3**	The students will learn about sustainable techniques to enhance soil health, control weeds naturally, and prevent pests and diseases in an eco-friendly manner, promoting long-term agricultural sustainability.	2,3
V	Operational structure of NPOP. Certification process and standards of organic farming. Processing, levelling, economic considerations and viability of organic products. Marketing and export potential of organic products.	**4**	The students will learn about the operational structure of NPOP, the certification process and standards of organic farming, including processing, levelling, economic considerations, viability, and the marketing and export potential of organic products.	2,3

Practical				
1	Preparation of enrich compost	**30**	To study the process of composting, enhancing soil fertility, and promoting sustainable waste management.	2,3
2	Preparation of vermicompost		To study the process of converting organic waste into nutrient-rich compost using earthworms, identifying suitable materials.	1,2
3	Preparation of bio-fertilizers/bio-inoculants and their quality analysis		To study the methods for preparing bio-fertilizers, bio-inoculants, and their quality analysis, ensuring effective application and optimal performance in agriculture.	2,3
4	To study about Indigenous technology knowledge (ITK) for nutrient management		To study the Indigenous Technology Knowledge (ITK) in sustainable nutrient management practices, promoting eco-friendly agricultural solutions.	1,2,3
5	To study about Indigenous technology knowledge (ITK) for weed management		To study the traditional practices, their effectiveness, and integration into modern sustainable agriculture.	2,3
6	To study about Indigenous technology knowledge (ITK) for pest and disease management		To study the Indigenous Technology Knowledge (ITK) for effective pest and disease management.	1,2,3
7	Estimation of cost of Organic production system		To learn how to calculate and analyse the financial aspects, including inputs, labour, and returns, involved in organic farming.	2,3,4
8	Post harvesting management of organic products		To study about proper handling, storage and packaging techniques to maintain quality, minimize waste and ensure sustainability.	2,3
9	Quality aspect, grading, packaging and handling of organic products		To study the factors which influence organic product quality, the grading system used, and best practices for packaging and handling to maintain product integrity and consumer trust.	2,3
10	Visit of organic farms to study the various components and their utilization		To learn about sustainable farming practices, components, and their utilization for environmental and agricultural benefits.	2,3

TEXT BOOKS:

T1: Bansal, M. 2018. Basics of Organic Farming, CBS Publishers & Distributors, New Delhi.

REFERENCE BOOKS:

R1: Baradkar, D.D. 2021 Organic farming system for Sustainable Agriculture, Sakal media Publication, India.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Building knowledge on principle of organic farming and initiatives taken by government for its promotion.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Understanding organic ecosystem and resources.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Decide on suitable crop and varieties in organic farming.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Recommend organic crop management techniques.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Recognize the process of organic seed certification.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Farm Management, Production & Resource Economics**								
Course Code	**23BSAG3209R**	**Total Credits: 2** **Total Hours: 15T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			1	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To equip students with the principles and techniques of farm management, enabling them to analyse farm enterprises, optimize resource use, and enhance farm profitability. 2. To develop an understanding of production economics and resource allocation, focusing on input-output relationships, cost analysis, and efficient decision-making in agricultural production. 3. To familiarize students with economic principles applied to agricultural resources, including land, labour, capital, and risk management, for sustainable and profitable farm operations.								
CO1	Develop an understanding of fundamental principles of farm management, including planning, organization, and decision-making for efficient resource allocation.								
CO2	Analyses production economics concepts, including production functions, cost analysis, and optimization techniques for maximizing farm profitability.								
CO3	Evaluates resource use efficiency in agriculture by applying economic principles to land, labour, capital, and enterprise combinations.								
CO4	Assesses risk and uncertainty in farm business management and develops strategies for mitigating economic and financial risks in agricultural enterprises.								
CO5	Examines the role of farm records, budgeting, and investment analysis in improving farm productivity and long-term sustainability.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm.	**3**	The students will understand the meaning, concept, and objectives of farm management, its relationship with other sciences, and the various types and characteristics of farms. They will also explore the factors influencing farm types and sizes. They will gain knowledge of the production function concept and its types, applying them in decision-making. They will be able to estimate gross farm income, net farm income, family labour income, and farm business income.	1,2
II	Factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing	**3**	The students will understand the relationships between factors of production and their outputs, and apply the law of equi-marginal utility and opportunity cost in economic decision-making. The learner will also gain knowledge of the types of costs, their interrelationships, and the importance	2,3,4

	farm business and estimation of gross farm income, net farm income, family labour income and farm business income.		of cost management in farm businesses. They will be able to estimate gross farm income, net farm income, family labour income, and farm business income.	
III	Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.	**4**	The student will understand the meaning and concept of farm income, profitability, and the efficiency measures in both crop and livestock enterprises, emphasizing their role in farm business analysis. They will also grasp the meaning and significance of farm planning and budgeting, including partial and complete budgeting, and will apply linear programming techniques for optimal farm resource allocation and enterprise selection.	2,3,4
IV	Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.	**2**	The students will understand the concept of risk and uncertainty in agricultural production, identify the nature and sources of risks, and explore various risk management strategies and gain knowledge about different types of agricultural insurance, including weather-based crop insurance, and understand the features, determinants of compensation, and their application in risk mitigation.	2,3,4
V	Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.	**3**	The students will be able to distinguish between natural resource economics (NRE) and agricultural economics, and identify the unique properties of natural resources in relation to economic management and evaluate key issues in the economics and management of common property resources, including land, water, pasture, and forest resources.	2,3

Practical				
1	Preparation of farm layout.		Students will be able to design and plan an efficient farm layout by considering factors like land topography, water management, and crop requirements.	2,3
2	Determination of cost of fencing of a farm.		Students will learn to calculate the cost of fencing a farm using appropriate methods and materials.	2,3,4
3	Computation of depreciation cost of farm assets.		Students will understand and to calculate the depreciation cost of farm assets using appropriate methods and principles.	2,3,4
4	Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.		Students will analyse the application of the equi-marginal returns and opportunity cost principles for optimal allocation of farm resources.	2,3,4
5	Determination of most profitable level of inputs use in a farm production process.		Students will identify the most profitable level of input use in farm production by applying economic principles and optimization techniques.	1,2,3
6	Determination of least cost combination of inputs.	**30**	Students will analyse methods for determining the least-cost combination of inputs to optimize agricultural production efficiency.	2,3,4
7	Selection of most profitable enterprise combination.		Students will identify and evaluate the most profitable enterprise combination using economic principles and optimization techniques.	1,2,5
8	Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.		Students will apply cost principles, including CACP concepts, to estimate the cost of crop and livestock enterprises.	2,3
9	Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.		The students will analyse the process of preparing a farm plan and budget for efficient resource allocation and evaluate farm profitability through the preparation and analysis of profit and loss accounts.	2,3,4
10	Collection and analysis of data on various resources in India.		The students will learn to analyse data on various resources in India, applying appropriate collection and interpretation methods.	2,3,4

TEXT BOOKS:

T1: Johl, S.S. and Kapur, J.R. 2006. Fundamentals of Farm Business Management, Kalyani Publishers, New Delhi

REFERENCE BOOKS:

R1: Subba Reddy, S., Raghu Ram, P. and Sastry, T.V.N. and Bhavani Devi, I. Agricultural Economics Second Edition, Oxford & IBH Publising Co. Pvt. Ltd, New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Develop an understanding of fundamental principles of farm management, including planning, organization, and decision-making for efficient resource allocation.	1, 2, 3, 4, 9, 11, 12
2	Analyses production economics concepts, including production functions, cost analysis, and optimization techniques for maximizing farm profitability.	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12
3	Evaluates resource use efficiency in agriculture by applying economic principles to land, labor, capital, and enterprise combinations.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Assesses risk and uncertainty in farm business management and develops strategies for mitigating economic and financial risks in agricultural enterprises.	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12
5	Examines the role of farm records, budgeting, and investment analysis in improving farm productivity and long-term sustainability.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Principles of Food Science and Nutrition**								
Course Code	**23BSAG3210R**	**Total Credits: 2** **Total Hours: 30T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. Understand the Fundamental Principles of Food Science and Nutrition 2. Analyze the Role of Microbiology and Food Processing Techniques in Food Safety and Preservation 3. Evaluate the Impact of Nutrition on Human Health and Develop Balanced Diets								
CO 1	Apply fundamental food science concepts practically for food analysis and experimentation								
CO 2	Assess food composition and chemistry to evaluate nutritional value and sensory properties								
CO 3	Evaluate microbial aspects of food safety and fermentation in food production								
CO 4	Utilize food processing and preservation techniques to extend shelf life and ensure safety								
CO 5	Design balanced diets and adapt menu planning to address nutritional needs and current trends								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Food Science and Food Composition- Concepts of Food Science: Definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems. Food Composition and Chemistry: Water, carbohydrates, proteins, fats. Vitamins, minerals, flavors, colors. Miscellaneous bioactives (antioxidants, phytochemicals, etc.).Important chemical reactions in foods (Maillard reaction, enzymatic browning, etc.).	**6**	Students will be able to demonstrate an understanding of the fundamental concepts in food science and food composition, including key chemical reactions such as the Maillard reaction and enzymatic browning. They will be able to describe the physical properties of food components (e.g., density, pH, osmosis, surface tension, colloidal systems) and explain how various bioactive compounds (such as antioxidants and phytochemicals) impact food quality, nutrition, and safety.	2,3
II	Food Microbiology, Microbial Flora in Foods: Bacteria, yeast, moulds. Spoilage of Fresh and Processed Foods: Mechanisms of spoilage. Identification and control measures. Production of Fermented Foods: Principles of fermentation. Types of fermented foods (e.g., dairy, vegetables, beverages).	**6**	To identify and describe the roles of different microbial species (bacteria, yeast, molds) in food spoilage and fermentation, explain the mechanisms behind spoilage of both fresh and processed foods, and apply control measures to prevent spoilage. Additionally, students will be able to explain the principles of fermentation and differentiate between various types of fermented foods such as dairy, vegetables, and beverages.	1,2
III	Principles of Food Processing and Preservation. Food Processing Methods: Heat (e.g., pasteurization, sterilization). Low temperature (e.g.	**6**	Critical evaluation of various food processing methods (e.g., heat, low temperature, chemical, radiation, and drying techniques) and their impact on the preservation of nutrients, food safety, and	2,3, 5

	refrigeration, freezing). Chemical methods (e.g., preservatives, antioxidants). Radiation (e.g., ionizing radiation for sterilization). Drying techniques (e.g., sun drying, freeze drying). Preservation of Nutrients and Safety: Impact of processing on nutritional value. Prevention of nutrient losses.		shelf-life, while identifying strategies to minimize nutrient losses during food processing.	
IV	Food and Nutrition- Malnutrition: Over nutrition and undernutrition. Nutritional disorders: obesity, scurvy, rickets, etc. Energy Metabolism: Carbohydrates, fats, and proteins in energy production. Digestive pathways and energy balance. Balanced Diets: Components of a balanced diet. Macronutrient and micronutrient needs.	**6**	Analyze and explain the concepts of over nutrition and undernutrition, identify common nutritional disorders (such as obesity, scurvy, and rickets), and understand the role of carbohydrates, fats, and proteins in energy metabolism. Additionally, students will be able to describe the digestive pathways involved in energy balance and recognize the components of a balanced diet, including the macronutrient and micronutrient needs for optimal health.	2,3, 4
V	New Trends in Food Science and Nutrition Modern Developments in Food Science: Technological advancements in food processing. Emerging food products (e.g., plant-based foods, lab-grown meat).Nutrition and Health Trends: Functional foods and nutraceuticals. Menu planning for health and special diets. Role of diet in prevention of chronic diseases (e.g., heart disease, diabetes).	**6**	Will be able to analyze and evaluate modern trends in food science and nutrition, including technological advancements in food processing, emerging food products such as plant-based foods and lab-grown meat, and the role of functional foods and nutraceuticals in health. They will also develop the ability to design menu plans that promote health, address special dietary needs, and prevent chronic diseases such as heart disease and diabetes.	2,3, 4,5

TEXT BOOKS:

T1: Srilakshmi, V., Sangamithra, B.and Suganthi, S. (2020). Principles of Food Science and Nutrition Sciences. New Age International

REFERENCE BOOKS:

R1: Srilakshmi, B. Food Science. New Age International Publishers

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Apply fundamental food science concepts practically for food analysis and experimentation	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Assess food composition and chemistry to evaluate nutritional value and sensory properties	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Evaluate microbial aspects of food safety and fermentation in food production	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Utilize food processing and preservation techniques to extend shelf life and ensure safety	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Design balanced diets and adapt menu planning to address nutritional needs and current trends	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI										
Course Title	**System Simulation and Agro advisory**									
Course Code	**23BSAG3211R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
			2	**0**	**2**	**0**	**0**	**0**	**3**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B.Sc. (Hons.) Agriculture**									
Semester	**Spring/6th Semester of Third Year of the Programme**									
Course Objectives	1. This course equip students with the ability to model real-world systems and simulate their behavior using appropriate techniques and software tools. 2. Provide students with the knowledge and skills to use information and communication technologies (ICT) to offer timely, relevant, and actionable advice to farmers 3. Teach students how to advise farmers on sustainable farming methods, soil health, crop management, and pest control, contributing to long-term agricultural sustainability.									
CO1	Understand the concepts and theoretical consideration in mechanistic model development.									
CO2	Acquired the skills to collect environmental data and use in mechanistic models.									
CO3	Ability to forecast environmental parameters of agricultural landscapes.									
CO4	Acquired the competency to develop agro-advisory and dissemination of traditional practices of crop management using weather data									
CO5	Application of knowledge of agronomy and technology to provide solutions that help farmers improve yields, reduce costs, and promote long-term agricultural sustainability, contributing to food security and rural development.									

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, and relational diagrams.	**6**	Students will be able to describe the interconnected relationship between the soil, plant, and atmosphere and how they function as a continuum in agricultural systems, different types of crop models, including empirical, mechanistic, and hybrid models, and will understand their applications in predicting crop growth, yield, and resource use efficiency. Students will gain knowledge of key concepts and techniques used in crop modelling, such as simulation, calibration, validation, and sensitivity analysis, and how they help in understanding crop behaviour. Students will be able to apply a systems approach to crop modelling, integrating the various components (soil, plant and atmosphere) and their interactions to develop comprehensive and realistic models.	1,2
II	Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept	**5**	Students will be able to evaluate how weather variables (e.g., temperature, rainfall, sunlight) affect crop growth, development, and yield, and how to incorporate these factors into crop modelling, the basic principles behind elementary crop growth models, including how these models simulate crop growth stages and predict yield under varying environmental conditions. Students will gain proficiency in	2,3,5

	and modelling techniques for their estimation		using modelling techniques to estimate both potential and achievable crop production, factoring in environmental variables, crop management practices, and weather forecasts.	
III	Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	**6**	Students will be able to explain how moisture and nutrient limitations affect crop growth and productivity, and how to adapt crop management practices to these constraints. Students will develop an understanding of how soil water management and nutrient management are interconnected, and how an integrated approach can enhance crop growth and yield under limiting conditions.	2,3
IV	Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars	**8**	Students will be able to explain the basic principles behind weather forecasting, including the methods used to predict weather patterns and the importance of accurate forecasting for agricultural planning. Students will understand the concept of value-added weather forecasts, including how tailored, localized weather information can benefit specific sectors like agriculture, and how to interpret forecasts for decision-making in crop management. Students will gain insight into the role of Indigenous Technical Knowledge (ITK) in weather forecasting, learning about traditional methods used by local communities for weather prediction and the importance of validating and integrating ITK with modern meteorological techniques. Students will learn to create and use crop-weather calendars, understanding how the timing of weather events (e.g., rainfall, temperature, frost) influences agricultural practices and crop growth stages, and how these calendars help optimize planting, irrigation, and harvesting schedules.	1,2,3
V	Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.	**5**	Students will be able to prepare detailed agro-advisory bulletins using weather forecast data, translating weather predictions into practical advice for farmers on optimal planting, irrigation, pest control, and harvest timings. Students will gain an understanding of how crop simulation models can be used to simulate and predict crop growth and yield based on weather forecasts and other environmental variables, thereby improving the accuracy of agro-advisory recommendations.	2,3,6
Practical				
1	Preparation of crop weather calendars.	**30**	Students will gain an understanding of how weather variables (e.g., rainfall, temperature, humidity, sunlight) influence different stages of crop growth and development and learn to develop crop-weather calendars by identifying the critical weather periods for specific crops, mapping them to growth stages (e.g.,	2,3

			germination, flowering, maturity), and determining optimal planting and harvesting windows based on seasonal weather patterns.	
2	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.		Students will be able to integrate weather data, synoptic charts, and different forecasting approaches to prepare actionable agro-advisories that help farmers optimize crop management and improve productivity.	2,3,6
3	Working with statistical and simulation models for crop growth.		Students will be equipped with the practical skills and knowledge to work with statistical and simulation models for crop growth, enabling them to analyze, predict, and optimize agricultural productivity under varying environmental conditions.	2,3,5
4	Potential & achievable production; yield forecasting, insect & disease forecasting models.		Students are equipped to use forecasting models effectively to predict crop yields and manage pest/disease risks, optimizing agricultural productivity while minimizing losses due to environmental and biological factors.	2,3
5	Simulation with limitations of water and nutrient management options.		Students will gain hands-on experience in using simulation models to explore various water and nutrient management strategies under limited conditions, such as deficit irrigation, nutrient use efficiency, and soil fertility management.	2,3
6	Sensitivity analysis of varying weather and crop management practices.		Students will learn to apply sensitivity analysis to understand and optimize the impact of variable weather conditions and crop management practices, thereby improving agricultural decision-making and sustainability.	2,3
7	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast		Students will learn to apply statistical methods to analyse meteorological data effectively, preparing them to contribute to the development of reliable medium-range weather forecasts and informed decision-making processes.	2,3,4
8	Feedback from farmers about the agro advisory		Students will be equipped with the skills to gather and analyse feedback from farmers, which will help improve the relevance, accuracy, and impact of agro-advisories for better agricultural decision-making.	2,3,4

TEXT BOOKS:

1. Walkenbach, J., Tyson, H. Groh, M.R. and Wempen, F. 2011. Microsoft Office 2010 Bible. John Wiley & Sons Inc.

2. Jain, S. and Geeta, M. and Kratika. 2010. MS-Office 2010 Training Guide. BPB Publications.

REFERENCE BOOKS:

R1. Bangia, R. 2015. Learning MS Office 2010. Khanna Book Publishing Company

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the concepts and theoretical consideration in mechanistic model development.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Acquired the skills to collect environmental data and use in mechanistic models.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Ability to forecast environmental parameters of agricultural landscapes.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Acquired the competency to develop agro-advisory and dissemination of traditional practices of crop management using weather data	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Application of knowledge of agronomy and technology to provide solutions that help farmers improve yields, reduce costs, and promote long-term agricultural sustainability, contributing to food security and rural development.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VI									
Course Title	**Hi-Tech Horticulture**								
Course Code	**23BSAG3211R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. Equip with knowledge of advanced horticultural techniques, including nursery management, micro-propagation, and modern planting methods, to enhance crop productivity and sustainability 2. Focuses on the application of protected cultivation, micro-irrigation systems, and precision-based fertilizer scheduling to optimize resource use and improve crop quality. 3. Learn about precision farming tools and mechanized harvesting to enhance efficiency, reduce labour dependency, and improve yield in fruit, vegetable, and ornamental crop production.								
CO1	Explain the significance of hi-tech horticultural practices in improving productivity and sustainability.								
CO2	Apply nursery management, mechanization, and micro-propagation techniques for quality planting material.								
CO3	Implement protected cultivation, micro-irrigation, and precision-based fertilizer scheduling.								
CO4	Utilize precision farming tools like GIS, DGPS, remote sensing, and VRA for efficient crop management.								
CO5	Adopt canopy management, high-density orcharding, and mechanized harvesting for better yield and efficiency.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops	**6**	Understand the importance of hi-tech horticulture, apply nursery management and mechanization techniques, and utilize micro-propagation for the efficient production of high-quality planting materials.	1,2
II	Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components	**6**	Learn modern field preparation and planting methods, understand the benefits and techniques of protected cultivation under controlled conditions, and implement micro-irrigation systems for efficient water and nutrient management.	2,3
III	Use of EC, pH-based fertilizer scheduling, canopy management, high density orcharding	**6**	Learn the application of EC and pH-based fertilizer scheduling, implement canopy management techniques, and adopt high-density orcharding for enhanced crop productivity and resource efficiency.	2,3
IV	Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System	**6**	Understand and apply remote sensing, GIS, DGPS, and VRA technologies for precision farming and site-specific crop management in horticulture.	2,3

	(DGPS), Variable Rate applicator (VRA)			
V	Components of precision farming, application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.	**6**	Learn the components of precision farming and apply these techniques to horticultural crops (fruits, vegetables, and ornamental crops), along with utilizing mechanized harvesting methods to improve efficiency and yield.	2,3
Practical				
1	Types of polyhouses and shade net houses	**30**	Differentiate types of polyhouses and shade net houses, operate horticultural tools, apply micro-propagation techniques, perform nursery planting in portrays, implement micro-irrigation with EC/pH-based fertilizer scheduling, manage plant canopy for optimal growth, and prepare value-added tomato and canned products.	2, 3, 4, 6
2	Intercultural operations, tools and equipment's identification and application			
3	Micro propagation			
4	Planting in Nursery-portrays			
5	Micro-irrigation, EC, pH based fertilizer scheduling			
6	Canopy management			
7	Preparation of tomato products, canned products			
8	Quality evaluation of products- physico-chemical and sensory			
9	Visit to processing unit/ industry.			

TEXT BOOKS:

T1: Kumar, C.D.H., Kumari, N.R., Naidu, L.N., Latha, V.S. 2024. Glimpses of Hi-Tech Horticulture. S.K. Kataria and Sons.

REFERENCE BOOKS:

R1: Ahirwar, S., Lohare, J., Singh, P.P., Ahirwar, M.K. 2023. Introduction to Hi-Tech Horticulture. Taneesha Publishers.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Explain the significance of hi-tech horticultural practices in improving productivity and sustainability.	1, 2, 3, 4, 5, 6, 8, 11, 12
2	Apply nursery management, mechanization, and micro-propagation techniques for quality planting material.	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12
3	Implement protected cultivation, micro-irrigation, and precision-based fertilizer scheduling.	1, 2, 4, 5, 6, 8, 9, 10, 11, 12
4	Utilize precision farming tools like GIS, DGPS, remote sensing, and VRA for efficient crop management.	1, 2, 3, 4, 5, 6, 10, 11, 12
5	Adopt canopy management, high-density orcharding, and mechanized harvesting for better yield and efficiency.	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12

SEMESTER – VI										
Course Title	**Agricultural Journalism**									
Course Code	**23BSAG3211R**	**Total Credits: 3** **Total Hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			2	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. Equip students with specialized writing, editing, and illustrating skills for effectively communicating agricultural information through various media. 2. Provide comprehensive understanding of the unique aspects of agricultural journalism, including the nature, scope, and comparison with other journalism types. 3. Offer hands-on training in interviewing, event coverage, and publication processes, enhancing students' readiness for careers in agricultural media and communications.									
CO1	Define the nature, scope, and characteristics of agricultural journalism, and differentiate it from other types of journalism									
CO2	Explain the role, functions, and readership characteristics of newspapers and magazines as communication media in agriculture.									
CO3	Demonstrate the ability to gather agricultural information through interviews, event coverage, and research abstraction to develop well-structured news stories									
CO4	Critically evaluate the use of photographs, artwork, and captions to enhance the readability and impact of agricultural stories.									
CO5	Develop well-edited, visually appealing, and audience-focused agricultural content by applying copy reading, proofreading, headline writing, and layout design techniques.									

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Agricultural Journalism: The nature and scope of agricultural journalism Characteristics and training of the agricultural journalist. How agricultural journalism is similar to and different from other types of journalism	**5**	Define the nature, scope, and characteristics of agricultural journalism, and differentiate it from other types of journalism	1,2
II	Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines	**6**	Explain the role, functions, and readership characteristics of newspapers and magazines as communication media in agriculture.	1,2
III	The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources	**5**	Demonstrate the ability to gather agricultural information through interviews, event coverage, and research abstraction to develop well-structured news stories	2,3

	Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures.			
IV	Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.) Writing Captions	**6**	Critically evaluate the use of photographs, artwork, and captions to enhance the readability and impact of agricultural stories.	2,3,5
V	Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing	**8**	Develop well-edited, visually appealing, and audience-focused agricultural content by applying copy reading, proofreading, headline writing, and layout design techniques.	2,3,6
Practical				
1	Practice in interviewing	**30**	Demonstrate effective interviewing techniques to gather accurate and relevant information during agricultural events.	2,3
2	Covering agricultural events.		Critically assess the coverage of agricultural events, ensuring comprehensive and balanced reporting.	2,3
4	Abstracting stories from research and scientific materials and from wire services.		Analyse and abstract relevant agricultural stories from research, scientific materials, and wire services, applying critical thinking and synthesis skills to effectively convey complex information	2,3,4
5	Writing different types of agricultural stories.		Analyse and create various types of agricultural stories, demonstrating proficiency in structuring content, selecting appropriate topics, and applying effective storytelling techniques for diverse agricultural audiences."	2,3,4 ,6
6	Selecting pictures and artwork for the agricultural story.		Evaluate and select appropriate pictures and artwork, such as photographs, charts, and maps, to effectively enhance the narrative and visual appeal of agricultural stories	2,3,5
7	Practice in editing, copy reading, headline and title writing, proofreading, layouting.		Apply and demonstrate proficiency in editing, copy reading, headline and title writing, proofreading, and layout design, effectively refining content for clarity, accuracy, and visual appeal.	2,3
8	Testing copy with a readability formula.		Apply readability formulas to test and assess the clarity and accessibility of written content, enhancing the effectiveness of agricultural journalism for diverse audiences.	2,3
9	Visit to a publishing office		Analyse the operations and workflows within a publishing office, applying critical thinking to understand the role of each department in the production of agricultural media content.	2,3,4

TEXT BOOKS:

T1: Sreekumar, M.S. Agricultural Journalism
T2: Samanta, R. K. Development Communication and Journalism: A Case Study Approach.

REFERENCE BOOKS:

R1: Ellis, J.B., Irani, T.A. and Holt, J.E. Agricultural Communications in Action: A Guide to Extreme Writing and Editing

R2: Handbook of Agricultural Extension. ICAR.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Define the nature, scope, and characteristics of agricultural journalism, and differentiate it from other types of journalism	3, 5, 11
2	Explain the role, functions, and readership characteristics of newspapers and magazines as communication media in agriculture.	3, 5, 11
3	Demonstrate the ability to gather agricultural information through interviews, event coverage, and research abstraction to develop well-structured news stories	3, 5, 11
4	Critically evaluate the use of photographs, artwork, and captions to enhance the readability and impact of agricultural stories.	3, 5, 11
5	Develop well-edited, visually appealing, and audience-focused agricultural content by applying copy reading, proofreading, headline writing, and layout design techniques.	3, 5, 11

SEMESTER – VI									
Course Title	**Food Safety & Standards**								
Course Code	**23BSAG3211R**	**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**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/6th Semester of Third Year of the Programme**								
Course Objectives	1. To provide students with a clear understanding of food safety concepts, focusing on the identification, prevention, and control of hazards in the food production, processing, and distribution chains. 2. To familiarize students with national food safety regulations (e.g., FSSAI) and international standards (e.g., Codex Alimentarius), and their role in ensuring food quality and safety globally. 3. To prepare students to ensure food safety compliance with relevant regulations and apply quality assurance measures, including food testing, inspection, and audits, in food processing and handling operations.								
CO1	Students will be able to apply the core principles of food safety, including hazard analysis, risk assessment, and control measures, to ensure safe food production and handling practices across the food supply chain.								
CO2	Students will gain an in-depth understanding of food safety regulations and standards, including national (e.g., FSSAI) and international (e.g., Codex Alimentarius) frameworks, and will be able to ensure food safety compliance in various food sectors.								
CO3	Students will be able to implement and manage food safety management systems like ensuring that food production and processing meet safety and quality requirements.								
CO4	Students will be able to identify foodborne hazards (biological, chemical, physical) and apply appropriate control measures to mitigate risks in the food production, processing, and distribution stages.								
CO5	Students will develop the skills to conduct food safety inspections, audits, and testing, ensuring adherence to food safety laws, regulations, and quality standards, thereby contributing to public health protection and consumer safety.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design.	**6**	Students will develop a comprehensive understanding of food safety, including its definition, significance, and scope in the food industry, and the factors that influence food safety in various stages of food production and distribution. Students will understand the need for hazard management and develop knowledge of strategies for controlling food safety risks, including the importance of temperature control, food storage, and product design to prevent contamination and ensure food safety.	1,2
II	Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their	**6**	Students will gain a comprehensive understanding of the importance of hygiene and sanitation in food service establishments, including how these principles are essential to ensuring food safety and protecting consumer health.	1,2

	control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures.			
III	Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.	**6**	Students will gain a thorough understanding of the fundamental concepts of food safety management tools and systems, including the role of **Pre-Requisite Programs (PRPs)**, **Good Hygiene Practices (GHPs)**, **Good Manufacturing Practices (GMPs)**, and **Sanitation Standard Operating Procedures (SSOPs)** in ensuring food safety. Students will develop an in-depth understanding of the **Hazard Analysis and Critical Control Points (HACCP)** system, learning how to implement HACCP principles to identify, evaluate, and control food safety hazards in food production and processing environments. Students will become familiar with various ISO standards related to food safety, including ISO 22000, and understand how these international standards guide the establishment and maintenance of food safety management systems. Students will gain practical knowledge of **water analysis** and **surface sanitation** techniques, understanding their critical role in maintaining hygienic conditions and preventing contamination in food production and handling environments.	2,3
IV	Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens.	**6**	Students will gain a comprehensive understanding of the **Indian food regulatory framework**, including the role and functions of the **Food Safety and Standards Authority of India (FSSAI)** in regulating food safety, labelling, and standards in India. Students will develop a thorough understanding of the **Food Safety and Standards Act (FSSA)** and its provisions, focusing on the legal requirements for food safety, food labelling, food additives, and contaminants, and how these regulations protect consumer health. Students will learn about the global food safety standards and the role of the **Codex Alimentarius Commission (CAC).**	1,2,3
V	Packaging, Product labelling and Nutritional labelling. Genetically modified foods/ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.	**6**	Students will be well-equipped to understand the critical aspects of food packaging, labelling, and safety regulations, as well as the broader trends affecting food safety, including GM foods, organic foods, and global food safety standards.	2,3

Practical				
1	Water quality analysis physico-chemical and microbiological	**30**	Students will acquire both theoretical knowledge and practical skills to assess and manage water quality, contributing to public health and environmental sustainability.	2,3
2	Preparation of different types of media		Students will learn to prepare different media for specific micro –organisms.	2,3
3	Microbiological Examination of different food samples		Students are equipped with the knowledge and practical skills to perform microbiological examinations of food samples, assess food safety, and contribute to preventing foodborne illnesses.	2,3
4	Assessment of surface sanitation by swab/rinse method.		Students gain practical skills to evaluate surface sanitation effectively and learn to apply these techniques to maintain high hygiene standards in food production and service environments.	2,3
5	Assessment of personal hygiene. Biochemical tests for identification of bacteria.		Students are proficient in assessing personal hygiene in food handling environments and are equipped with the necessary skills to conduct biochemical tests for bacterial identification, contributing to enhanced food safety and pathogen control.	2,3
6	Scheme for the detection of food borne pathogens		Students can effectively apply microbiological and molecular techniques for detecting foodborne pathogens, which is crucial for maintaining food safety and preventing foodborne illnesses.	2,3
7	Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000		Students are equipped with the knowledge and practical skills to develop and implement robust food safety management systems using HACCP and ISO 22000 standards, ensuring effective food safety practices across the food production chain.	2,3

TEXT BOOKS:

T1: Ali, I. 2004. Food Quality Italics Assurance: Principles and Practices. CRC Press, Boca.

T2: Ronald, R., Schmidt, H. and Rodrick. G.E. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.

REFERENCE BOOKS:

R1: Hester, R.E. and Harrison R.M. 2001. Food Safety and Food Quality. Royal Society of Chemistry, Cambridge, UK.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Students will be able to apply the core principles of food safety, including hazard analysis, risk assessment, and control measures, to ensure safe food production and handling practices across the food supply chain.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Students will gain an in-depth understanding of food safety regulations and standards, including national (e.g., FSSAI) and international (e.g., Codex Alimentarius) frameworks, and will be able to ensure food safety compliance in various food sectors.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Students will be able to implement and manage food safety management systems like ensuring that food production and processing meet safety and quality requirements.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Students will be able to identify foodborne hazards (biological, chemical, physical) and apply appropriate control measures to mitigate risks in the food production, processing, and distribution stages.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Students will develop the skills to conduct food safety inspections, audits, and testing, ensuring adherence to food safety laws, regulations, and quality standards, thereby contributing to public health protection and consumer safety.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VII									
Course Title	**Rural Agricultural Work Experience**								
Course Code	**23BSAG4101R**	**Total Credits: 14**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 420P	**0**	**0**	**28**	**0**	**0**	**0**	**14**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 7th Semester of Fourth Year of the Programme**								
Course Objectives	1. To provide an opportunity to the students to understand the rural setting in relation to agriculture and allied activities 2. To impart diagnostic and remedial knowledge to the students relevant to real field situations through practical training 3. To develop communication skills in students using extension teaching methods in transfer of technology and acquaint them with on-going extension and rural development programmes								
CO1	Analyse the socio-economic conditions, farming practices, and resource management strategies of rural communities.								
CO2	Apply practical knowledge of farm planning, cropping patterns, and extension methodologies to support rural farmers.								
CO3	Gain exposure to rural agribusiness models, agro-processing units, and value chain management for enhancing farm productivity and income.								
CO4	Identify key challenges in rural farming systems and develop innovative, sustainable solutions for agricultural and allied sector development.								
CO5	Strengthen interpersonal skills, teamwork, and leadership abilities through direct interaction with farmers, extension agencies, and rural stakeholders.								

Unit-No.		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1**	Sustainable agricultural practices, including meteorological data collection, organic manure production, composting methods, nutrient and fertilizer management, weed control, soil and water conservation, watershed management, integrated farming systems. **Collection and analysis of soil, water, manure, and compost** to assess nutrient status and provide recommendations for optimal agricultural productivity. Horticultural practices, including **seedbed preparation, sowing, planting, and transplanting** of vegetable and flower crops.	**420**	Students will acquire practical knowledge of sustainable agricultural practices, including soil and water conservation, nutrient management, integrated farming systems, and horticultural techniques, along with skills in meteorological data collection and soil, water, and compost analysis for improved agricultural productivity.	2,3
	2	Importance of plant selection techniques, seed preservation for sustainable crop production, awareness about Farmers' Rights under the PPV & FR Act, 2001, Information on released crop varieties and hybrids and gathering farmer		Understand the importance of plant selection techniques, seed preservation, and Farmers' Rights under the PPV & FR Act, 2001, while gaining knowledge of released crop varieties,	2,3

		feedback for further improvement in seed selection and agricultural productivity.		hybrids, and farmer feedback for improving seed selection and agricultural productivity.	
	3	Important plant diseases of major crops and their severity, information about different types of non-chemical inputs, information on conventional or local practices of disease management, cultural and biological management of soil borne disease, preparation of spray solutions, Identification of local pest situations /problems, diagnosis of insect and mite pests; Demonstration of IPM practices for major pests; situation analysis and situation based on recommendations of plant protection measures; analysis of cost of plant protection measures in major crops grown in the location, analysis of recommended plant protection measures versus farmers' practices, preparation of floral calendar		Students will gain knowledge of major plant diseases, non-chemical and conventional disease management practices, IPM strategies, pest identification, plant protection measures, and cost-benefit analysis of plant protection in major crops.	2,3,4
	4	Economic principles of practical application in micro level problems faced by farmers in agriculture; Cost effectiveness of different agricultural technologies, Costing valuing inputs, relative profitability of crops, livestock, horticulture, fishery enterprises; Risks and uncertainties involved in cultivation and marketing and mitigation strategies, Economic efficiency, Gaps inefficiency, productivity and how to address them. Appraising the selected farmers regarding the economic solutions to the problems identified		Students will be able to apply economic principles to analyse and solve micro-level agricultural problems, assess cost-effectiveness of technologies, evaluate profitability across enterprises, manage risks and uncertainties, enhance economic efficiency, and provide economic solutions to farmers.	2,3,4
	5	Extension programme planning and Execution, Leadership in rural areas and identification of leaders to use in Extension work, Participatory Rural Appraisal (PRA) techniques for efficient extension work, Extension teaching methods like General meeting, Farm and Home Visit, Group discussion meeting, Method Demonstration, Result Demonstration, Campaign, Farmers Training, Exhibition, Field Visits, Field days, Community work etc.		Students will develop the skills to plan and execute effective extension programs, identify and engage rural leaders, apply Participatory Rural Appraisal (PRA) techniques, and utilize various extension teaching methods to enhance agricultural outreach and community development.	2,3,6

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Analyse the socio-economic conditions, farming practices, and resource management strategies of rural communities.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Apply practical knowledge of farm planning, cropping patterns, and extension methodologies to support rural farmers.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Gain exposure to rural agribusiness models, agro-processing units, and value chain management for enhancing farm productivity and income.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Identify key challenges in rural farming systems and develop innovative, sustainable solutions for agricultural and allied sector development.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Strengthen interpersonal skills, teamwork, and leadership abilities through direct interaction with farmers, extension agencies, and rural stakeholders.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VII									
Course Title	**Plant Clinic**								
Course Code	**23BSAG4102R**	**Total Credits: 2** **Total Hours: 60P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 7th Semester of Fourth Year of the Programme**								
Course Objectives	1. **Diagnose Plant Diseases and Pests:** To identify common plant diseases, pests, and environmental stress factors that affect plant health, providing accurate diagnoses for proper treatment and prevention. 2. **Provide Expert Advice on Plant Care:** To offer guidance on plant maintenance, including watering, fertilizing, pruning, and pest control, ensuring plants receive the best care for healthy growth. 3. **Promote Sustainable Gardening Practices:** To educate gardeners on eco-friendly gardening techniques, such as the use of organic fertilizers, natural pest control, and water conservation methods, to support sustainable plant care.								
CO1	Diagnose Plant Diseases: Students will be able to accurately identify and diagnose common plant diseases, pests, and environmental stresses through visual inspection and diagnostic tools.								
CO2	Develop Integrated Pest Management Strategies: Students will demonstrate the ability to create integrated pest management (IPM) plans for sustainable control of plant pathogens and pests, incorporating cultural, biological, and chemical methods.								
CO3	Understand Plant Pathology Principles: Students will gain a foundational understanding of plant pathology, including the mechanisms of plant disease development, host-pathogen interactions, and the role of environmental factors in disease spread.								
CO4	Apply Plant Health Diagnostics Techniques: Students will be proficient in using laboratory and field techniques, such as microscopy, serology, molecular methods, and soil analysis, to assess plant health and diagnose issues effectively								
CO5	Educate and Advise Clients on Plant Health Management: Students will be able to communicate effectively with plant owners, farmers, and landscapers, offering sound advice on plant health management, including preventative measures and treatment options.								

Unit-No.		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1**	Plant Identification and Diagnosis- Learn how to identify common plant species, understand their characteristics, and diagnose plant diseases and pests.	**60**	Hands-on practice with identifying plants and symptoms of diseases on real plants in various stages of growth.	2,3
	2	Soil Testing and Amending- Understand soil composition, how to test soil health, and amend soils for better plant growth.		Collecting soil samples, performing basic tests, and applying organic and chemical amendments based on the results.	2,3,5
	3	Integrated Pest Management (IPM) - Introduction to integrated pest		Monitoring plant pests and implementing IPM strategies	2,3

		management strategies, including the use of biological, mechanical, and chemical controls.		in a controlled environment, such as a garden or greenhouse.	
	4	Propagation Techniques- Learn different plant propagation methods like cuttings, grafting, and seed starting.		Hands-on propagation of various plant species from cuttings or seeds.	2,3
	5	Fertilization and Plant Nutrition- Study the different nutrients required by plants and how to apply fertilizers correctly.		Mixing different fertilizers, applying them to plants, and assessing plant responses to different types of fertilizers.	2,3
	6	Plant Pest and Disease Control (Chemical & Organic)- Explore various methods of controlling pests and diseases, including both chemical and organic treatments.		Application of organic pesticides and chemical fungicides, alongside biological controls (e.g., releasing beneficial insects).	2,3
	7	Plant Health Assessment and Management- Diagnosing plant health issues like nutrient deficiencies, diseases, and environmental stress.		Inspecting plants for signs of stress, documenting symptoms, and providing treatment plans or corrective actions.	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Diagnose Plant Diseases: Students will be able to accurately identify and diagnose common plant diseases, pests, and environmental stresses through visual inspection and diagnostic tools.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Develop Integrated Pest Management Strategies: Students will demonstrate the ability to create integrated pest management (IPM) plans for sustainable control of plant pathogens and pests, incorporating cultural, biological, and chemical methods.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Understand Plant Pathology Principles: Students will gain a foundational understanding of plant pathology, including the mechanisms of plant disease development, host-pathogen interactions, and the role of environmental factors in disease spread.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Apply Plant Health Diagnostics Techniques: Students will be proficient in using laboratory and field techniques, such as microscopy, serology, molecular methods, and soil analysis, to assess plant health and diagnose issues effectively	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Educate and Advise Clients on Plant Health Management: Students will be able to communicate effectively with plant owners, farmers, and landscapers, offering sound advice on plant health management, including preventative measures and treatment options.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VII									
Course Title	**Agro-Industrial Attachment**								
Course Code	**23BSAG4103R**	**Total Credits: 4** **Total Hours: 120P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**8**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 7th Semester of Fourth Year of the Programme**								
Course Objectives	1. To enhance students' technical and managerial skills by engaging them in real-world agro-industrial settings, enabling them to understand industry practices, challenges, and solutions. 2. To provide students with hands-on experience and practical exposure to the daily activities, processes, and operations of agro-industries related to their respective subject areas. 3. To facilitate a strong linkage between academic knowledge and industrial applications by allowing students to work in identified agro-industrial units, thereby improving their employability and entrepreneurial capabilities.								
CO1	Acquaint students with the day-to-day operations, management practices, and challenges in agro-industrial enterprises								
CO2	Develop technical and managerial skills relevant to different agro-industrial sectors through hands-on experience in specialized domains								
CO3	Analyse the linkages between agriculture and agribusiness industries, focusing on value addition, supply chain management, and market dynamics								
CO4	Identify real-world challenges in agro-industries and propose practical, research-based solutions for improved efficiency and productivity								
CO5	Cultivate teamwork, communication, and leadership skills, preparing students for career opportunities in agro-based industries and entrepreneurship								

Unit-No		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1**	Introduction to Agro-Industrial Attachment with overview of various agro-industrial sectors and institutional framework for agro-industrial placement.	**120**	Students will understand about the significance of agro-industrial attachment, key agro-industrial sectors, and the institutional framework for effective industry placement.	1,2
	2	Industry Placement and Work Environment		Students will gain practical experience and develop professional skills by applying agribusiness concepts in a real industry placement, enhancing their understanding of the work environment.	2,3
	3	Subject Specific Industrial Exposure		Students will gain practical insights and hands-on experience in agribusiness operations, enhancing understanding of industry practices, challenges, and solutions	2,3
	4	Business and Management Practices in Agro-Industries		Students will be able to analyse and apply effective business and management practices to optimize the operations and growth of agro-industries.	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Acquaint students with the day-to-day operations, management practices, and challenges in agro-industrial enterprises.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Develop technical and managerial skills relevant to different agro-industrial sectors through hands-on experience in specialized domains.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Analyse the linkages between agriculture and agribusiness industries, focusing on value addition, supply chain management, and market dynamics.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Identify real-world challenges in agro-industries and propose practical, research-based solutions for improved efficiency and productivity.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Cultivate teamwork, communication, and leadership skills, preparing students for career opportunities in agro-based industries and entrepreneurship.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER – VII									
Course Title	**Production Technology For Bio agents and Biofertilizer**								
Course Code	**23BSAG4201R**	**Total Credits: 10** **Total Hours: 300P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Fall/ 7th Semester of Fourth Year of the Programme**								
Course Objectives	1. Understanding the Fundamentals of Bio agent Production- basic principles and processes involved in the production of bio agents, such as bacteria, fungi used for agricultural or industrial purposes. Explore the types of bio agents commonly produced and their applications. Gain hands-on experience with laboratory techniques for culturing and isolating bio agents. 2. To equip students with the skills to scale up bio agent production, ensure high-quality, cost-effective production for commercial purposes. 3. To have hands on experience on production of biofertilizers.								
CO1	Understand the fundamentals of bio agent production.								
CO2	Design pilot-scale and industrial-scale production processes for bio agents used in agriculture and environmental management.								
CO3	Demonstrate practical knowledge in the production, storage, and application of bio agents and biofertilizers								
CO4	Analyse the limitations and quality control measures associated with biofertilizers.								
CO5	Evaluate the economic and ecological benefits of adopting bio-based agricultural inputs over synthetic alternatives.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
	Practical			
1	Microbial Culture Media Preparation & Sterilization Techniques • Preparation of various culture media (e.g., solid and liquid media, agar plates, broth) • Understanding the composition of different culture media for bio-agents. • Techniques for autoclaving and sterilization. • Inoculation methods for culturing microorganisms. • Contamination control measures	**300**	Learners will be able to effectively prepare and sterilize various microbial culture media, including solid (agar plates) and liquid (broth), understand the composition and function of different culture media for bio-agent cultivation, apply autoclaving and sterilization techniques, perform proper inoculation methods for culturing microorganisms, and implement contamination control measures to ensure aseptic conditions during microbial work.	2,3
2	Production of Biofertilizers Using Microbial Inoculants • Selection and isolation of appropriate microbial strains like Trichoderma spp. • Mass production of biofertilizers		Students will be able to effectively select, isolate, and mass-produce microbial inoculants for biofertilizers, while demonstrating an understanding of the critical growth parameters (such as temperature, pH, and nutrient content) required for optimal microbial	2,3

	• Monitoring growth parameters like temperature, pH, and nutrient content. • Methods for inoculating the soil or plants with biofertilizers.		growth. Additionally, students will gain the skills to properly inoculate soil and plants with biofertilizers.	
3	Packaging and storage techniques for biofertilizers products.		Implement appropriate packaging and storage techniques to maintain product efficacy	2,3,6
4	Isolation of AM fungi -Wet sieving method and sucrose gradient method.		Gain skills in isolating AM fungi using the wet sieving and sucrose gradient methods, understanding the procedures for efficient fungal separation.	2,3
5	Mass production of AM inoculants.		Gain hands-on experience in the mass production of AM inoculants, including the techniques and conditions necessary for large-scale cultivation and inoculation.	2,3

TEXT BOOKS:

T1: Acharya, K., Sen,S. Rai,M. (2019). Biofertilizers and Biopesticides. Techno World; First Edition

REFERENCE BOOKS:

R1: Khosla,R. (2017). Biofertilizers and Biocontrol Agents for Organic Farming. Kojo Press

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the fundamentals of bio agent production.	5, 6, 12
2	Design pilot-scale and industrial-scale production processes for bio agents used in agriculture and environmental management.	5, 6, 12
3	Demonstrate practical knowledge in the production, storage, and application of bioagents and biofertilizers	5, 6, 12
4	Analyse the limitations and quality control measures associated with biofertilizers.	5, 6, 12
5	Evaluate the economic and ecological benefits of adopting bio-based agricultural inputs over synthetic alternatives.	5, 6, 12

SEMESTER- VIII										
Course Title	**Seed Production and Technology**									
Course Code	**23BSAG4202R**	**Total Credits: 10** **Total Hours: 300P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. To provide a solid foundation in types of seed and seed production in various crops. 2. To impart knowledge on seed production, storage and marketing. 3. To impart knowledge on seed testing, field inspection for seed certification.								
CO1	Understand the concepts of quality seed production in different crops.								
CO2	Learn about seed drying, processing, cleaning, testing and packaging.								
CO3	Understand the optimal conditions for seed storage to maintain viability.								
CO4	Acquire knowledge on seed marketing and factors affecting seed marketing.								
CO5	Entrepreneurship skills necessary to contribute to the seed industry and understand challenges related to seed production and marketing.								

Unit-No.		**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical	**1.**	Book keeping of records and accounts of Seed Production	**300**	Acquaint with record keeping of seed production	2,3
	2.	Acquaintance of seed classes, seed sources, labels, purchase norms under certification scheme.		Learn about various classes of seed, seed sources	2,3
	3.	Planning and layout of seed production plot under field conditions.		Study about plot layout	2,3
	4.	Seed production in major cereals		Study seed production in cereals.	2,3
	5.	Seed production in major vegetables		Study seed production in major vegetables.	2,3
	6.	Application of isolation distance requirements as per certification standards		Learn about isolation distance in various crops	2,3
	7.	Preparation of land and application of manures and fertilizers, etc.		Study about land preparation	2,3
	8.	Preparation and raising of nursery beds/seedling		Prepare nursery beds for various crops	2,3,6
	9.	Timely management of aftercare operations at various growth stages of crops		Study about aftercare operations in the field	2,3
	10.	Acquaintance of different methods of conducting field inspections		Study about different types of field inspection	2,3
	11.	Determination of physiological maturity in hybrid seed production		Learn about physiological maturity	2,3

	12.	Acquaintance of working designs of threshers, cleaners, driers, processing and packaging machinery.		Learn about different implements and tools	1,2,3
	13.	Acquaintance of manual method of sorting and grading as per minimum certification standards and procedures.		Learn about sorting and grading methods	2,3
	14.	Visit to seed production farms.		Learn about seed production.	2,3
	15.	Visit to seed testing laboratories and seed processing plant.		Learn about seed testing in seed testing laboratories.	2,3

TEXT BOOKS:

R1: Agrawal, R.L. 2018. Seed Technology. Oxford and IBH Publishing Co Pvt. Ltd.

REFERENCE BOOKS:

R2: Singh, P. 2013. Principles of Seed Technology, Kalyani Publishers.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the concepts of quality seed production in different crops.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
2	Learn about seed drying, processing, cleaning, testing and packaging.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
3	Understand the optimal conditions for seed storage to maintain viability.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
4	Acquire knowledge on seed marketing and factors affecting seed marketing.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
5	Entrepreneurship skills necessary to contribute to the seed industry and understand challenges related to seed production and marketing.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

SEMESTER- VIII									
Course Title	**Mushroom Cultivation and Technology**								
Course Code	**23BSAG4201R**	**Total Credits: 10** **Total Hours: 300P**	**L** **0**	**T** **0**	**P** **20**	**S** **0**	**R** **0**	**O/F** **0**	**C** **10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. Understanding Mushroom Biology and Growth Requirements to provide students with a foundational knowledge of mushroom species, their life cycles, and the environmental and substrate requirements needed for successful cultivation. 2. Mastering Cultivation Techniques and Technologies to equip students with practical skills in growing mushrooms through various cultivation methods, including controlled environment systems, substrate preparation, inoculation, and harvesting techniques. 3. Exploring Innovation and Sustainability in Mushroom Production to introduce students to cutting-edge technologies, sustainable practices, and advancements in the mushroom industry, emphasizing innovations in automation, waste reduction, and environmentally friendly cultivation methods.								
CO1	Understand the Fundamentals of Mushroom Biology and Growth. Students will be able to describe the biological processes of mushroom growth, including the stages of development (spawn, colonization, fruiting) and environmental conditions required for optimal production.								
CO2	Identify and Classify Edible and Medicinal Mushrooms. Students will gain the ability to identify common edible and medicinal mushroom species, understanding their characteristics, nutritional value, and medicinal properties.								
CO3	Apply Techniques for Substrate Preparation and Sterilization. Students will be proficient in preparing and sterilizing substrates (such as straw, sawdust, or compost) for mushroom cultivation and understand how to prevent contamination through proper techniques.								
CO4	Design and Manage a Mushroom Cultivation System. Students will be capable of designing a small-scale or commercial mushroom production system, including space planning, temperature and humidity control, and maintenance of optimal growing conditions.								
CO5	Implement Harvesting, Post-Harvest Handling, and Marketing Strategies Students will understand how to efficiently harvest mushrooms, apply post-harvest handling methods, and develop strategies for marketing and selling fresh or processed mushrooms in local or global markets.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
	Practical			
1	Introduction to Mushroom Cultivation Understand the basics of mushroom cultivation, types of mushrooms, and the significance of mushroom farming. • Overview of different types of mushrooms (e.g., button	**300**	Learners will be able to identify different types of mushrooms, understand the basic processes involved in mushroom cultivation, and evaluate the benefits of mushroom farming for both	1,2,5

	mushrooms, oyster mushrooms, shiitake). • Discuss the benefits of mushroom farming for personal and commercial purposes. • Visit a local mushroom farm or watch a demonstration on mushroom growing.		personal consumption and commercial purposes.	
2	Mushroom Biology and Fungi- • Study the structure of a mushroom (mycelium, fruiting body, spores). • Examine a live mushroom specimen under a microscope. • Demonstrate how mushrooms grow from spores to the fruiting body.		Students will be able to describe the life cycle and structure of mushrooms, identifying key components such as the mycelium, fruiting body, and spores, and demonstrate an understanding of how mushrooms grow from spores to the fruiting body by observing and analysing a live mushroom specimen under a microscope.	2,3
3	Setting Up a Mushroom Farm • Learn about the required temperature, humidity, and light conditions. • Demonstrate creating a growing space (e.g., grow room or greenhouse). • Discuss the importance of hygiene and sterilization in preventing contamination.		Learners will be able to set up a mushroom farm by effectively creating a suitable growing environment, maintaining proper temperature, humidity, and light conditions, and implementing hygiene and sterilization practices to prevent contamination, ensuring optimal growth conditions for mushrooms.	2,3,6
4	Preparation of Substrate for Mushroom Cultivation • Prepare the substrate (e.g., sterilize and moisten sawdust or straw). • Inoculate substrate with mushroom spawn. • Discuss different substrates used for different types of mushrooms.		Students will be able to identify and prepare suitable substrates for different types of mushrooms, understand the process of sterilization and inoculation, and distinguish between various substrate options based on the mushroom species they are cultivating (e.g., sawdust, straw, or other organic materials)	1,2,3
5	Spawn Production • Demonstrate the process of making spawn from spores (inoculation onto a sterile substrate). • Discuss the different types of spawn (grain spawn, sawdust spawn, plug spawn). • Learn about incubation conditions for spawn growth.		Students will be able to demonstrate the process of creating spawn from spores by inoculating sterile substrates, identify and differentiate between various types of spawn (grain, sawdust, and plug), and understand the optimal incubation conditions necessary for successful spawn growth.	1,2,3
6	Inoculation of Substrate with Spawn- • Step-by-step inoculation of the substrate in a clean and sterile manner. • Proper sealing and placement of the inoculated substrate in incubation rooms.		Learners will be able to successfully inoculate a substrate with spawn in a clean and sterile manner, ensuring proper sealing and placement in incubation rooms. They will also be able to monitor and maintain optimal conditions,	1,2,3,6

	• Discuss the incubation process and how to maintain optimal conditions (temperature and humidity).		including temperature and humidity, during the incubation process to support healthy mycelial growth and successful substrate colonization.	
7	Monitoring Growth and Mycelium Colonization- • Check for mycelial growth on substrates (how to identify good colonization). • Track the time required for full colonization. • Learn how to recognize and address contamination issues (e.g., mold, bacterial growth).		Students will be able to effectively monitor and assess mycelium colonization on substrates by identifying healthy mycelial growth, tracking the time required for full colonization, and recognizing early signs of contamination (such as mold and bacterial growth), while demonstrating the ability to implement appropriate interventions to address and prevent contamination.	2,3
8	Fruiting and Harvesting • Learn how to change environmental conditions to induce fruiting (temperature, humidity, light). • Demonstrate the process of pinning (when small mushrooms start to form). • Harvest mushrooms properly to avoid damage to the fruiting body. • Discuss post-harvest storage and shelf life.		earners will be able to identify and manipulate the environmental factors (temperature, humidity, and light) required to induce mushroom fruiting, demonstrate the pinning process, harvest mushrooms correctly to prevent damage, and apply proper post-harvest storage techniques to maximize shelf life.	1,2,3
9	Pest and Disease Management • Identify common pests and diseases affecting mushrooms (e.g., fungal infections, flies). • Demonstrate the use of organic or natural methods to control pests. • Discuss sanitation techniques to prevent contamination.		Learners will be able to identify common pests and diseases affecting mushrooms, such as fungal infections and flies, demonstrate the use of organic or natural methods for pest control, and apply effective sanitation techniques to prevent contamination in mushroom cultivation.	1,2,3
10.	Marketing and Commercialization of Mushrooms • Learn about different methods of selling mushrooms (local markets, online platforms, restaurants). • Discuss packaging and labelling techniques. • Explore cost analysis, pricing strategies, and business planning for mushroom farming.		Learners will be able to effectively market and commercialize mushrooms by identifying various sales channels (local markets, online platforms, restaurants), utilizing appropriate packaging and labelling techniques, and applying cost analysis, pricing strategies, and business planning methods to develop a sustainable mushroom farming business.	2,3

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Understand the Fundamentals of Mushroom Biology and Growth Students will be able to describe the biological processes of mushroom growth, including the stages of development (spawn, colonization, fruiting) and environmental conditions required for optimal production.	1, 2, 4, 5, 7, 12
2	Identify and Classify Edible and Medicinal Mushrooms Students will gain the ability to identify common edible and medicinal mushroom species, understanding their characteristics, nutritional value, and medicinal properties.	1, 2, 4, 5, 7, 12
3	Apply Techniques for Substrate Preparation and Sterilization Students will be proficient in preparing and sterilizing substrates (such as straw, sawdust, or compost) for mushroom cultivation and understand how to prevent contamination through proper techniques.	1, 2, 4, 5, 7, 12
4	Design and Manage a Mushroom Cultivation System Students will be capable of designing a small-scale or commercial mushroom production system, including space planning, temperature and humidity control, and maintenance of optimal growing conditions.	1, 2, 4, 5, 7, 12
5	Implement Harvesting, Post-Harvest Handling, and Marketing Strategies. Students will understand how to efficiently harvest mushrooms, apply post-harvest handling methods, and develop strategies for marketing and selling fresh or processed mushrooms in local or global markets.	1, 2, 4, 5, 7, 12

SEMESTER- VIII									
Course Title	**Soil, Plant, Water and Seed Testing**								
Course Code	**23BSAG4204R**	**Total Credits: 10** **Total Hours: 300P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. To improve skills of students in Soil, Plant and Water testing 2. To develop proficiency in Seed testing. 3. To analyse profitability of setting up soil, water, plant and seed testing laboratory.								
CO1	Explain the principles and importance of analytical techniques used in soil, water, and plant analysis.								
CO2	Perform the collection, preparation, and preservation of soil, water, and plant samples for laboratory analysis.								
CO3	Conduct laboratory tests to determine soil pH, electrical conductivity, sodium adsorption ratio, exchangeable sodium percentage, and nutrient content in soil, water, and plant samples.								
CO4	Interpret laboratory results to assess soil fertility, irrigation water quality, and plant nutrient status for effective agricultural recommendations.								
CO5	Apply practical knowledge of seed morphology, germination and viability.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
		Practical		
1	Soil sampling and soil testing procedures	**300**	Develop practical skills in collecting soil samples and laboratory analysis of the samples for their physico-chemical and microbiological properties.	2,3,4
2	Water sampling and water testing procedures		Develop practical skills in collecting water samples and laboratory analysis of the samples for their quality.	2,3,4
3	Plant tissue analysis for nutrient content		Identifying proper stage for plant tissue collection and their laboratory analysis for available nutrients.	1,2,4
4	Seed morphology study, germination and viability tests		Understand seed physiological parameters and ability to test seed germination and viability.	2,3,4
5	Analyse profitability of setting up soil, water, plant and seed testing laboratory		Understand the economics behind setting up of soil, water plant testing and seed testing laboratory.	2,3,4

TEXT BOOKS:

T1: Gurumurthy, P., Santosh, B.and Yasmin, C. (2019). Practical Manual for Soil, Plant, Water and Seed Testing. Educreation Publishing

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Explain the principles and importance of analytical techniques used in soil, water, and plant analysis.	1, 2, 4, 5, 7, 12
2	Perform the collection, preparation, and preservation of soil, water, and plant samples for laboratory analysis.	1, 2, 4, 5, 7, 12
3	Conduct laboratory tests to determine soil pH, electrical conductivity, sodium adsorption ratio, exchangeable sodium percentage, and nutrient content in soil, water, and plant samples.	1, 2, 4, 5, 7, 12
4	Interpret laboratory results to assess soil fertility, irrigation water quality, and plant nutrient status for effective agricultural recommendations.	1, 2, 4, 5, 7, 12
5	Apply practical knowledge of seed morphology, germination and viability.	1, 2, 4, 5, 7, 12

SEMESTER – VIII									
Course Title	**Commercial Beekeeping**								
Course Code	**23BSAG4205R**	**Total Credits: 10**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 300P	**0**	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. To provide practical knowledge and skills in beekeeping for commercial purposes. 2. To understand the biology, management, and operation of beekeeping. 3. To gain hands-on experience in managing bee colonies for honey production, pollination services, and other hive products.								
CO1	Develop a comprehensive understanding of modern beekeeping techniques, including hive management, colony maintenance, and implement best practices for ensuring healthy, productive bee colonies.								
CO2	Develop practical skills in the production, harvesting, and processing of honey and other bee products (like wax, propolis, and royal jelly), learning how to maximize yields while maintaining the quality and purity of products for commercial sale								
CO3	Understand the economic potential of commercial beekeeping, including cost analysis, profit margins, marketing strategies, business planning and develop a sustainable business model.								
CO4	Explore the role of bees in pollination services for agriculture along with focussing on the importance of bee health for pollination efficiency, crop yields, and the overall agricultural ecosystem, learning how to integrate beekeeping with other farming operations for mutual benefits.								
CO5	To gain knowledge of common bee pests, diseases, and environmental threats (like varroa mites, Nosema, etc.), and develop the ability to identify, manage, and prevent these issues to maintain colony health and productivity in a commercial setting.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
1	Introduction to Beekeeping, Basic Beekeeping Equipment's	**300**	• Overview of different bee species (e.g., Apis mellifera). Understanding bee colony structure (queen, worker, and drone) Life cycle of bees. • Introduction to hive boxes (Langstroth, top bar hives, etc.). • Protective gear (suits, gloves, veils). • Tools for managing hives (smokers, hive tools, frames).	1,2
2	Setting Up and Preparing for Beekeeping		Choosing an optimal site for an apiary (sheltered, sunny spots, near forage areas). Apiary management practices. How to install bees in a new hive (package bees, nucleus colony). Familiarization with bee transportation. Adjusting hive environments to suit bee colonies.	1,2

3	Bee Colony Management. Bee Health Management and Biosecurity		• Checking for the health of bees, brood, and queen. • Identifying diseases and pests (e.g., Varroa mites, Nosema, foulbrood). • When and how to feed bees (sugar syrup, pollen). • Monitoring hive temperature and humidity. • Preventing and managing swarming. Queen rearing basics. • Integrated pest management (IPM) strategies. • Medications and treatments for bee colonies. **Bee Biosecurity:** • Preventing the spread of diseases and pests. • Keeping records of hive health and treatments	2,3
4	Honey Production and Harvesting		**Hive Management for Honey Production:** • Understanding the flow of nectar and its conversion into honey. • Managing supers (boxes for honey storage) for honey production. **Honey Harvesting:** • Timing and methods of harvesting honey. • Using an extractor. • Straining and bottling honey for commercial sale. **Processing and Packaging:** • Ensuring hygienic practices for honey production. • Packaging and labelling for the market.	2,3,6
5	Pollination Services and Other Hive Products, Commercial Beekeeping Business Practices		**Pollination as a Business:** • Understanding how beekeepers provide pollination services to farms (fruit orchards, crop pollination). • Transporting hives to pollination sites. **Other Hive Products:** • Wax: Extraction and processing. • Propolis and royal jelly: Harvesting and their uses in commercial production. • Bee venom: Uses and harvesting techniques. **Value-added Products:** • Creating and marketing value-added products (beeswax candles, skincare products, etc.). **Business Planning and Marketing:** • Creating a business plan for a commercial beekeeping operation. • Marketing honey and other products (branding, local markets, online sales).	2,3,6

			• Costing, pricing, and budgeting for beekeeping operations. **Sustainability in Beekeeping:** • Eco-friendly practices and sustainability considerations. • The role of beekeeping in environmental conservation.	

TEXT BOOKS:

T1: Rahman A., Textbook on Beekeeping: Perspective for Skill Development, Kalyani Publishers, New Delhi.

REFERENCE BOOKS:

R1: Rahman A., Textbook on Beekeeping: Perspective for Skill Development, Kalyani Publishers, New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Develop a comprehensive understanding of modern beekeeping techniques, including hive management, colony maintenance, and implement best practices for ensuring healthy, productive bee colonies.	1, 2, 3, 4, 5, 6, 7, 10, 11, 12
2	Develop practical skills in the production, harvesting, and processing of honey and other bee products (like wax, propolis, and royal jelly), learning how to maximize yields while maintaining the quality and purity of products for commercial sale	1, 2, 3, 5, 6, 7, 8, 10, 11, 12
3	Understand the economic potential of commercial beekeeping, including cost analysis, profit margins, marketing strategies, business planning and develop a sustainable business model.	1, 2, 3, 4, 5, 6, 10, 11, 12
4	Explore the role of bees in pollination services for agriculture along with focussing on the importance of bee health for pollination efficiency, crop yields, and the overall agricultural ecosystem, learning how to integrate beekeeping with other farming operations for mutual benefits.	1, 2, 3, 4, 5, 6, 8, 10, 11, 12
5	To gain knowledge of common bee pests, diseases, and environmental threats (like varroa mites, Nosema, etc.), and develop the ability to identify, manage, and prevent these issues to maintain colony health and productivity in a commercial setting.	1, 2, 3, 6, 10, 11, 12

SEMESTER – VIII									
Course Title	**Poultry Production Technology**								
Course Code	**23BSAG4206R**	**Total Credits: 10** **Total Hours: 300P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. Develop hands-on skills in managing poultry breeding, incubation, and hatching processes, along with chick and bird care. 2. Gain practical experience in designing poultry housing, managing environmental conditions, and ensuring proper space allocation for different age groups. 3. Learn to prepare and formulate poultry feed, administer injections, and implement vaccination schedules while managing common poultry diseases.								
CO1	Recall the important Indian and foreign poultry breeds, common poultry diseases, and the structure of poultry eggs.								
CO2	Describe the principles of poultry breeding management, including incubation, hatching, and the care of chicks, grown birds, and layers.								
CO3	Demonstrate the use of poultry equipment, feeders, drinker systems, and housing designs, ensuring proper space and ventilation for different age groups.								
CO4	Analyse and interpret the requirements for brooder space, floor space, and feeding systems to optimize poultry growth at various stages.								
CO5	Formulate a feed plan for broilers of different age groups and design a vaccination schedule to prevent common poultry diseases.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
Practical				
1	Important Indian and foreign breeds of poultry.	**300**	Students will be able to identify and differentiate between important Indian and foreign breeds of poultry.	1,2
2	Breeding management of chick, grower and layer birds.		Students will gain practical knowledge in the breeding management of chicks, grower, and layer birds, ensuring optimal growth and productivity.	1,2,3
3	Incubation and hatching, management of incubator during incubation		Students will learn various identification methods for farm animals and poultry, including tagging, branding, tattooing, and notching.	1,2,3
4	Students will gain hands-on experience in setting up and managing incubators during incubation, monitoring temperature, humidity, and egg turning to ensure optimal hatching conditions.		Students will gain practical exposure by visiting IDF and IPF to study livestock and poultry breeds, observe daily farm operations, and understand farm record-keeping.	2,3

5	Equipment, feeders, drinker systems, housing programs.		Students will gain practical experience in using poultry equipment, including feeders, drinker systems, and designing housing programs that ensure optimal growth and welfare of poultry.	2,3
6	Farm knout, house design, orientation of shed, cross ventilation, lighting systems.		Students will learn to design poultry farm layouts, including the proper orientation of sheds, cross ventilation, and lighting systems to enhance bird health and productivity.	2,3,6
7	Floor space requirements, brooder space, water space and feeding space at different age of broilers.		Students will learn to calculate and allocate appropriate floor, brooder, water, and feeding space for broilers at various stages of growth to optimize their health and productivity.	2,3,4
8	Commonly used major feed ingredients identification; Feed manufacturing, preparation of feed for different age groups of broilers.		Students will gain hands-on experience in identifying commonly used feed ingredients and preparing balanced feed formulations for different age groups of broilers.	2,3
9	Different methods of injection and procedure.		Students will learn and practice different injection methods and procedures for administering vaccines and medications to poultry.	2,3
10	Structure of poultry eggs, selection and care of hatching egg.		Students will understand the structure of poultry eggs and learn how to select and care for hatching eggs to ensure successful incubation and hatching.	2,3
11	Disease of poultry.		Students will learn to identify common poultry diseases, their symptoms, and basic management practices for prevention and control.	1,2,3
12	Vaccination schedule.		Students will understand and be able to implement an effective vaccination schedule for poultry to prevent common diseases and ensure optimal health.	1,2,3

TEXT BOOKS:

T1: Ayalew, M. Modern Poultry Production Text Book. Lambert Academic Publishing.

REFERENCE BOOKS:

R1: Verma , J., Goyal , G., (2024). Poultry Production and Management: (Recent trends). New India Publishing Agency.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Apply management principles in rearing livestock and poultry, considering their economic significance	1, 4, 5, 10, 11, 12
2	Effectively manage reproduction, housing, and space requirements for various farm animals and poultry	1, 4, 5, 10, 11, 12
3	Identify, assess, and improve breeds of livestock and poultry, both indigenous and exotic	1, 4, 5, 10, 11, 12
4	Formulate balanced rations for livestock and poultry, incorporating feed supplements and additives	1, 4, 5, 10, 11, 12
5	Implement disease prevention and control measures, alongside practical skills in handling, identification, and culling	1, 4, 5, 10, 11, 12

SEMESTER – VIII									
Course Title	**Commercial Horticulture**								
Course Code	**23BSAG4207R**	**Total Credits: 10**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 300P	**0**	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. Develop hands-on skills in commercial horticulture, including nursery management, precision farming, and protected cultivation. 2. Enhance entrepreneurial abilities through market analysis, value chain management, and agribusiness planning. 3. Promote sustainable practices such as organic farming, hydroponics, and efficient post-harvest management.								
CO1	Demonstrate proficiency in commercial horticulture techniques, including nursery and crop management.								
CO2	Apply entrepreneurial skills to develop and manage horticulture-based agribusiness ventures.								
CO3	Implement sustainable practices such as organic farming, hydroponics, and integrated pest management.								
CO4	Manage post-harvest handling and value addition to enhance product quality and marketability.								
CO5	Analyse market trends and develop business strategies for commercial horticulture enterprises.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
1	Horticultural Crop Production & Management	**300**	Master horticultural production techniques, including nursery management, precision farming, and protected cultivation.	1,2,3
2	Post-Harvest Handling & Value Addition		Apply post-harvest handling and value addition skills to enhance product quality, shelf life, and market value.	2,3
3	Agri-Entrepreneurship & Business Development		Develop entrepreneurial and agribusiness management abilities, including financial planning, marketing, and supply chain management.	2,3,6
4	Sustainable & Climate-Resilient Horticulture		Implement sustainable and climate-smart horticultural practices, such as organic farming, water conservation, and renewable energy use.	2,3,6
5	Experiential Learning & Enterprise Setup		Gain hands-on experience through enterprise setup, field exposure, and interaction with industry experts to establish a successful horticulture business.	2,3,6

TEXT BOOKS:

T1: Patel, N.L., Chawla, S.L. and Ahlawat, T.R. 2015. Commercial Horticulture. New India Publishing Agency

REFERENCE BOOKS:

R1: Singh, J. 2017. Fundamentals of Horticulture, Kalyani Publishers, Ludhiana.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
S.N.	**Course Outcome**	**Mapped Programme Outcome**
1	Demonstrate proficiency in commercial horticulture techniques, including nursery and crop management.	1, 2, 5, 6, 12
2	Apply entrepreneurial skills to develop and manage horticulture-based agribusiness ventures.	1, 2, 3, 4, 5, 6, 10, 11, 12
3	Implement sustainable practices such as organic farming, hydroponics, and integrated pest management.	1, 2, 6, 8, 12
4	Manage post-harvest handling and value addition to enhance product quality and marketability.	1, 2, 5, 6, 8, 10, 11, 12
5	Analyse market trends and develop business strategies for commercial horticulture enterprises.	2, 5, 9, 10, 11

SEMESTER – VIII									
Course Title	**Floriculture and Landscaping**								
Course Code	**23BSAG4208R**	**Total Credits: 10**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 300P	**0**	**0**	**20**	**0**	**0**	**0**	**10**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Sc. (Hons.) Agriculture**								
Semester	**Spring/ 8th Semester of Fourth Year of the Programme**								
Course Objectives	1. Equip students with practical skills in floriculture production, including seedling propagation, flower cultivation, and pest management. 2. Develop expertise in landscape design and maintenance, covering plant selection, hardscaping, and sustainable gardening practices. 3. Enhance entrepreneurial skills for establishing and managing floriculture and landscaping businesses, focusing on marketing and project management.								
CO1	Acquire hands-on skills in floriculture production, including propagation, cultivation, and pest management.								
CO2	Design and implement functional and aesthetic landscape projects, using sustainable practices.								
CO3	Develop the ability to establish and manage a floriculture or landscaping business with effective marketing and financial strategies.								
CO4	Apply landscape maintenance techniques to ensure the long-term health and beauty of garden spaces.								
CO5	Demonstrate entrepreneurship and project management skills in floriculture and landscaping ventures.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
1	Floriculture Crop Production & Management	**300**	Demonstrate practical skills in floriculture crop production, including propagation, cultivation, and pest management techniques.	2,3
2	Landscape Design & Planning		Design and implement landscape plans, incorporating site analysis, plant selection, and hardscaping elements with sustainable practices.	2,3,6
3	Floriculture Business Development & Marketing		Develop entrepreneurial abilities to create and manage a floriculture or landscaping business, including market research, pricing, and cost analysis.	2,3
4	Landscape Maintenance & Garden Care		Apply landscape maintenance techniques to ensure healthy garden care, including pruning, pest control, and seasonal planting.	2,3
5	Entrepreneurship in Floriculture and Landscaping		Manage business operations in floriculture and landscaping, including customer relations, project management, and financial planning for profitability.	2,3

TEXT BOOKS:

T1: Salaria, A.S. and Salaria, B.S. A2Z Horticulture At A Glance Vol-3
T2: Bhattacharjee, S.K. and De, L.C. Advanced Commercial Floriculture 2 Vols. Aavishkar Publishers & Distributors.

REFERENCE BOOKS:

R1: Somani, L.L. 2010. Floriculture & Landscaping at a Glance, Agrotech Publishing Academy.

RELATIONSHIP BETWEEN COURSE OUTCOME (CO) AND PROGRAMME OUTCOME (PO)

CO PO Mapping		
SN	**Course Outcome**	**Mapped Programme Outcome**
1	Acquire hands-on skills in floriculture production, including propagation, cultivation, and pest management.	1, 2, 5, 6, 12
2	Design and implement functional and aesthetic landscape projects, using sustainable practices.	1, 2, 3, 4, 5, 6, 10, 11, 12
3	Develop the ability to establish and manage a floriculture or landscaping business with effective marketing and financial strategies.	1, 2, 6, 8, 12
4	Apply landscape maintenance techniques to ensure the long-term health and beauty of garden spaces.	1, 2, 5, 6, 8, 10, 11, 12
5	Demonstrate entrepreneurship and project management skills in floriculture and landscaping ventures.	2, 5, 9, 10, 11