

School of Agriculture, Forestry and Fisheries

Bachelor of Science in Agriculture

B.Sc. (Hons.) Agriculture

CURRICULUM

(Program Code:)

ACADEMIC YEAR: 2025-26

Program Span: 2025-2029



JIGYASA UNIVERSITY

Formerly
Hingiri Zee University, Dehradun
(Estd. Under Uttaranchal State Act.No.17, 2003.Approved by UGC Under
Sec.2(f))
Post Office Selaqui, Chakrata Road, Dehradun, Uttarakhand,248011

Vision of University

We provide the environment to ignite, nurture and unleash your potential and talent.

Mission Statement

- Progressive educational proficiencies that stimulate holistic development.
- Enhancing experiential learning through endorsing an inclusive mindset.
- Advancing research, nurturing innovations, and catalyzing entrepreneurship.
- Cultivation of leadership qualities with a strong sense of values and ethics.

Vision of SAFF

To become centre of advanced studies in the field of Agriculture, Forestry & Fisheries Education and Research to cater local, national and global needs.

Mission Statements of SAFF

- To provide quality education and research opportunities in the field of Agriculture and Allied Sciences.
- To engage in extension outreach activities for meeting the farmers and industry needs.
 - To inculcate the scientific aptitude through modern techniques and technologies.

About the Program

A. Introduction:

The National Education Policy (NEP) 2020 aims to transform India's education system to meet the developmental needs of the nation by focusing on holistic, flexible, and multidisciplinary learning. It emphasizes 21st-century skills, creativity, and innovation while aligning with the Sustainable Development Goal 4 (SDG-4) – Quality Education. The policy also draws inspiration from India's traditional knowledge systems and value-based education, ensuring a balance between modern scientific approaches and the country's rich cultural heritage. In this context, the B.Sc. (Hons.) Agriculture program at the School of Agriculture, Forestry and Fisheries (SAFF), Jigyasa University (Formerly Himgiri Zee University) Dehradun, has been developed to reflect the core principles of NEP 2020.

The B.Sc. (Hons.) Agriculture program is a four-year full-time degree designed under the Choice Based Credit System (CBCS), offering flexibility, academic depth, and industry relevance. The curriculum blends theory with practical learning, covering major fields such as agronomy, soil science, horticulture, agricultural economics, plant pathology, and sustainable farming. Students gain hands-on experience through laboratory work, field training, and the Rural Agricultural Work Experience (RAWE) program, which exposes them to real farming situations and rural development practices. The program promotes problem-solving, analytical thinking, innovation, and ethical understanding, preparing students to meet the evolving challenges of modern agriculture.

Through its strong foundation in both scientific and practical knowledge, the program opens diverse career opportunities in government departments, agribusiness firms, research institutions, and entrepreneurship. Graduates are equipped to contribute effectively to agricultural productivity, sustainability, and rural development. The B.Sc. (Hons.) Agriculture program at SAFF, Jigyasa University (Formerly Himgiri Zee University), truly embodies the vision of NEP 2020 by fostering experiential learning, interdisciplinary education, and environmental stewardship, thereby shaping skilled professionals ready to lead India's agricultural future.

B. National Higher Education Qualifications Framework (NHEQF) levels:

NHEQF Level	NHEQF Level	NHEQF Level	NHEQF Level	NHEQF Level
Level 5	Undergraduate Certificate	Completion of 1st year of UG program	~40 credits	Foundational knowledge and skills; eligible for vertical mobility
Level 6	Undergraduate Diploma	Completion of 2 years of UG program	~80 credits	Broader subject understanding; vocational and academic skills
Level 7	Bachelor's Degree (3 years)	10+2 (Senior Secondary)	~120 credits	Core disciplinary knowledge and cognitive skills
Level 7.5	Bachelor's Degree with Honours (4 years)	Based on strong academic performance	~160 credits	Advanced disciplinary depth; research exposure (Capstone)
Level 8	Bachelor's Degree with Research (4 years)	75%+ in previous semesters; research orientation	~160 credits + Research Project	Research, innovation, and preparedness for PG or direct PhD

C. Academic Bank of Credits (ABC):

In alignment with the National Education Policy (NEP) 2020, the Academic Bank of Credits (ABC) facilitates a flexible curriculum framework. It promotes interdisciplinary/multidisciplinary academic mobility among students across various Higher Educational Institutions (HEIs) through an appropriate credit transfer system. Accordingly, the School of Agriculture, Forestry and Fisheries under Jigyasa University, Dehradun, has developed a comprehensive four-year undergraduate program.

As a prerequisite, students/learners are required to register on the Academic Bank of Credits (ABC) portal. The credits earned during the study will be digitally stored in the ABC account. Learners must complete their program as per the guidelines of the UGC's ABC policy. Please note that the validity of earned credits is limited to seven years (or as per the latest advisory from the competent authority). Additionally, each credit earned may only be used once and cannot be reused for multiple programs or purposes.

D. Curriculum Framework:

I. Major Core Courses (MCC):

Major Courses (MCC) in the B.Sc. (Hons.) Agriculture program encompass a comprehensive range of subjects designed to provide students with a strong foundation in core agricultural sciences and allied disciplines. These courses are structured to develop students' analytical abilities, scientific understanding, problem-solving skills, and leadership potential in the field of agriculture. The curriculum integrates key areas such as agronomy, soil science, horticulture, agricultural economics, plant protection, and extension education to produce competent and well-rounded agricultural professionals capable of contributing to sustainable agricultural development.

The MCC includes courses such as Principles of Agronomy, Fundamentals of Soil Science, Agricultural Economics, and Agricultural Meteorology, which provide insights into crop production practices, soil fertility management, climatic influences on crops, and the economics of farming systems. Courses like Plant Pathology, Entomology, and Genetics & Plant Breeding emphasize the understanding of plant health, pest and disease management, and crop improvement for enhanced productivity. In addition, subjects such as Horticultural Science, Weed Management, and Irrigation and Water Management equip students with practical knowledge of sustainable cultivation techniques, resource utilization, and crop management strategies.

Furthermore, advanced courses like Agricultural Extension and Communication, Farm Management and Production Economics, and Agricultural Marketing and Trade prepare students to connect scientific research with field-level application, ensuring effective technology transfer and rural development. Courses such as Organic Farming, Natural Resource Management, and Agri-Entrepreneurship Development promote innovation, self-employment, and sustainable livelihood opportunities. Overall, the Major Courses in Agriculture integrate theoretical learning with field experience, laboratory work, and rural outreach programs, thereby preparing students to face real-world agricultural challenges and excel in government services, agribusiness, research, and entrepreneurial ventures.

II. Discipline Specific Elective Courses - (DSE)

In line with the National Education Policy (NEP) 2020, the B.Sc. (Hons.) Agriculture program offers specialized elective courses that allow students to align their studies with agricultural industry needs and career interests. These specializations include Landscaping, Mushroom Cultivation Technology, Food Science and Micro-Propagation. Each elective provides in-depth theoretical and practical knowledge to build domain-specific expertise and employable skills.

The NEP's focus on flexibility, multidisciplinary learning, and skill development is reflected in these electives, enabling students to apply scientific knowledge to real-world agricultural challenges. These specialization modules are introduced in the later semesters, after students acquire a strong foundation in core agricultural sciences, preparing them for professional and research-oriented careers in modern agriculture.

III. Multidisciplinary Courses (MDC)

In line with the National Education Policy (NEP) 2020, the B.Sc. (Hons.) Agriculture program includes multidisciplinary courses that integrate knowledge from various fields to provide a holistic understanding of agriculture and its linkages with society, environment, and technology. These courses go beyond core agricultural subjects to explore how disciplines such as Rural Development, Economics, Information Technology, and Social Sciences contribute to sustainable agricultural practices and rural transformation.

Students can choose from different discipline groups—such as Humanities and Social Sciences (HSS), , Digital and Technological Applications (DTA), and Rural and Community Development (RCD)—selecting one group consisting of three courses (each carrying 2 credits). This multidisciplinary approach enhances adaptability, innovation, and problem-solving skills, preparing students for the diverse challenges of modern agriculture.

IV. Skill Enhancement Courses (SEC)

In line with the National Education Policy (NEP) 2020, the B.Sc. (Hons.) Agriculture program offers Skill Enhancement Courses (SECs) aimed at developing practical, technical, and entrepreneurial skills essential for modern agricultural practices. These courses focus on hands-on learning, innovation, and employability by integrating field-based applications with scientific knowledge.

The curriculum includes courses such as Soil and Water Testing Techniques, Nursery Management, Vermicomposting and Organic Manure Production, Agro-Processing and Value Addition. Each course blends theory with practical exposure to enhance students' technical competence, problem-solving ability, and readiness for professional roles in farming, agribusiness, and allied sectors.

These skill-based modules make graduates industry-ready, self-reliant, and capable of contributing to sustainable agricultural development through modern tools, digital literacy, and entrepreneurial innovation.

V. Value-Added Courses (VAC)

In line with the National Education Policy (NEP) 2020 and the objectives of SDG 4 – Quality Education, the B.Sc. (Hons.) Agriculture program includes Value Added Courses (VACs) that promote sustainability, ethics, and holistic development alongside core agricultural studies. These courses aim to create socially responsible and environmentally conscious graduates equipped to address global agricultural and rural challenges.

The curriculum includes non-credit courses such as Modern Technology, which builds awareness of ecological balance and sustainable resource use; Ethics and Human Values, focusing on moral responsibility in agriculture; Entrepreneurship Development, encouraging innovation and self-employment in agribusiness; and Yoga and Wellness, supporting physical and mental well-being.

Together, these VACs foster sustainability, ethical leadership, and personal growth, preparing students for meaningful contributions to society and the agricultural sector.

VI. Innovation Enhancement Course (IEC):

In the B.Sc. (Hons.) Agriculture program, the Innovation Enhancement Course is a credit-based component offered during the 4th, 5th, and 6th semesters to nurture creativity, problem-solving, and research-oriented thinking among students. This course encourages learners to develop innovative solutions for real-world agricultural challenges through field-based projects, model development, experiments, and case studies. By integrating scientific knowledge with practical applications, it promotes entrepreneurial thinking, technological innovation, and sustainable farming practices. The course aims to build a culture of innovation and self-reliance among students, preparing them for leadership roles in modern and progressive agriculture.

VII. Ability Enhancement Courses (AEC):

In the B.Sc. (Hons.) Agriculture program, Ability Enhancement Courses (AECs) are credit-based courses designed to develop students' communication, leadership, analytical, and social skills essential for professional and community engagement. These courses focus on holistic growth beyond academics, promoting values of teamwork, responsibility, and social awareness. The curriculum includes courses such as Sādhyā – Social and Community Engagement, which involves participation in activities like cleanliness drives, social gatherings, and community outreach both within and outside the campus. Through these courses, students enhance their personality, civic sense, and leadership abilities, preparing them to become socially responsible and professionally competent agricultural graduates in alignment with the goals of the NEP 2020.

VIII. Audit Course (AC):

In the B.Sc. (Hons.) Agriculture program, Audit Courses are non-credit courses designed to enhance students' soft skills, personality development, and communication abilities alongside their academic learning. These courses focus on improving interpersonal skills, teamwork, leadership, time management, and professional ethics, which are essential for success in agricultural and allied sectors. Though not credit-based, they play a vital role in building confidence, fostering holistic growth, and preparing students to effectively engage with farming communities, agribusiness enterprises, and research organizations.

IX. Research Project (REP):

In alignment with the National Education Policy (NEP) 2020, which promotes research and innovation at the undergraduate level, the Research Project (REP) is introduced in the 7th semester of the B.Sc. (Hons.) Agriculture program. This component aims to develop a spirit of scientific inquiry, analytical thinking, and problem-solving skills among students. Under faculty supervision, students undertake discipline-specific research projects related to crop production, soil management, plant protection, agribusiness, or sustainable farming, culminating in the submission of a dissertation. They are also encouraged to present their findings at seminars or conferences and publish research papers. This hands-on research experience prepares students for higher studies, research-oriented careers, and innovation in agriculture, fulfilling the NEP's vision of nurturing a strong research culture in undergraduate education.

X. Industrial Practice (IP):

In the B.Sc. (Hons.) Agriculture program, Industrial Practice is introduced in the 8th semester to provide students with practical exposure to real-world agricultural operations and agribusiness management. This

component bridges theoretical learning with field applications by engaging students in training with agricultural industries, research institutes, agribusiness firms, cooperatives, or government organizations. During this period, students gain hands-on experience in modern farming techniques, input management, processing, marketing, and farm entrepreneurship. The Industrial Practice enhances professional competence, problem-solving ability, and industry readiness, preparing graduates to effectively contribute to the agricultural sector and rural development.

**Constitution of Courses in (B.Sc. (Hons.) Agriculture)
Matrix**

Course Category Name	Course Category Code	Number of Courses	Total Course Credits
Core Course	COR	16	36
Discipline Specific Elective	DSE	24	58
Remedial Courses*	REM	02	03
Skill Enhancement Courses	SEC	15	29
Value Added Course	VAC	07	(Q/NQ)
Multi- Disciplinary Course	MDC	01	(Q/NQ)
Innovation Enhancement Course	IEC	03	04
Audit Course	AC	06	(Q/NQ)
Research Project	REP	01	20
Industrial Practice	IP	01	20
\TOTAL		76	170

E. PEO's - Program Educational Objectives (B.Sc. (Hons.) Agriculture)

PEO1. To impart quality education and research opportunities in the field of Agriculture and Allied Sciences.

PEO2. To develop skills towards identifying the needs and problems of the farming community and generating amicable solutions thereof through modern technology.

PEO3. To encourage the importance of ethical integrity, personal growth and entrepreneurial skills among students which helps them in becoming future leaders.

PEO4. To empower students to plan & design independent projects in Agriculture & related fields.

PEO5. To develop a competitive teaching-learning environment for enabling students for higher studies in the field of agriculture.

F. PO's - Program Outcomes (B.Sc. (Hons.) Agriculture)

PO	Outcome	BT Level
PO1	Recall the important crops and their cultivation practices.	L1
PO2	Understand the theoretical and practical concepts of the different branches of Agriculture.	L2
PO3	Understand the professional, social and ethical responsibilities.	L2
PO4	Execute the knowledge for becoming Agri entrepreneur and give jobs to others.	L3
PO5	Apply the knowhow of the package of practices of crops in the field.	L3
PO6	Identify the problems occurring in wide variety of crops and recommending fruitful solutions.	L4
PO7	Select the Agro-Based Industries and Scientific Institutions for making successful careers in the field of Agriculture.	L5
PO8	Know the significance of higher education in the field of Agriculture in India and Abroad.	L5
PO9	Plan & Design independent Agro-based Projects.	L6

G. Pedagogy, Teaching & Learning:

In the B.Sc. (Hons.) Agriculture program, pedagogy combines theoretical teaching with experiential learning to ensure holistic understanding and skill development. Along with traditional lectures, the teaching approach includes field visits, laboratory work, demonstrations, case studies, group discussions, and project-based learning. These interactive and practical methods help students connect classroom concepts with real-life agricultural practices, promoting critical thinking, problem-solving, and hands-on competence in line with modern educational goals and the vision of the NEP 2020.

1. Experiential and Holistic Learning Approach:

The B.Sc. (Hons.) Agriculture program emphasizes experiential and holistic learning beyond traditional classroom teaching by integrating practical, participatory, and field-based pedagogies. Students actively engage through field visits, live farm projects, case studies, group assignments, demonstrations, and expert-led interactive sessions. They also participate in School Clubs, which promote teamwork, leadership, and innovation. Additionally, workshops,

seminars, mentorship programs, and co-curricular activities are organized to enhance practical understanding, critical thinking, and all-round development of students in alignment with the NEP 2020.

2. Industry Immersion:

In the B.Sc. (Hons.) Agriculture program, Industry Immersion is offered in the 8th semester to provide students with real-world exposure and practical experience in the agricultural sector. Through their course RAWE (Rural Agriculture Work Experience), students participate in industry–academia interactions, field training, live farm and agribusiness projects, industrial visits, and internships with reputed organizations. The program also includes career counselling, mock interviews, and placement drives to prepare students for professional roles. This hands-on exposure helps students connect theoretical knowledge with practical applications, enhancing their employability, entrepreneurship skills, and readiness for careers in agriculture and allied industries.

3. Library and E – Learning Access:

Course faculty actively encourage students to make regular use of the University Library and guide them in effectively utilizing its rich collection of physical and digital resources to support academic learning, subject-specific research, and overall knowledge enhancement. Additionally, students have access to a wide range of e-learning resources through their individual logins on the University’s ERP system, enabling continuous learning beyond the classroom environment.

4. Massive Open Online Courses:

Integration of MOOCs into the B.Sc. (Hons.) Agriculture Curriculum – Process Flow

In accordance with the National Education Policy (NEP) 2020 and UGC guidelines, MOOCs (Massive Open Online Courses) may be integrated into the B.Sc. (Hons.) Agriculture Curriculum.

- Before the commencement of each semester, a list of available MOOCs from platforms such as SWAYAM/NPTEL will be prepared by the Program Coordinators in consultation with the Dean of the School / Head of Department (HOD).
- The list will include suitable MOOCs that can replace theory courses in the following categories, except REP, IP and Practical Courses:
 - Core Courses (MCC)
 - Discipline-Specific Elective Courses (DSE)
 - Multidisciplinary Courses (MLC)
 - Skill Enhancement Courses (SEC)
 - Value-Added Courses (VAC)
- Students and faculty will collaboratively identify relevant MOOCs from the announced list that align with the learning objectives of the existing curriculum.
- The final selection of MOOCs will be notified officially by the Dean’s/HOD’s Office prior to the start of the semester.
- The selected MOOC will replace one existing theory course in the category it corresponds to, maintaining curriculum structure and credit equivalence.
- An in-house course faculty/coordinator will be assigned to:
 - Monitor students’ progress in the selected MOOCs
 - Track completion timelines and assessments
 - Provide academic support and resolve subject-related queries
 - Coordinate with students on submission schedules and internal records

Annexure II

H. Program Structure

Bachelor of Science in Agriculture

(B.Sc. (Hons.) Agriculture)

S. No.	Course Code	Course Name	Category	Numbers of Hours/Week			C
			Core / Elective / Others	L	T	P	
SEMESTER I							
1	AGR C101	Fundamentals of Horticulture	COR	1	0	2	2
2	AGR C102	Fundamentals of Soil Science	COR	2	0	2	3
3	AGR C103	Fundamentals of Agronomy	COR	2	0	2	3
4	-	Skill Enhancement Course-I	SEC	1	0	2	2
5	-	Skill Enhancement Course-II	SEC	1	0	0	1
6	-	Remedial Course-I*	REM	1	0	2	2
7	-	Remedial Course-II*	REM	2	0	0	2
8	-	Remedial Course-III	REM	1	0	0	1
9	-	Audit course-I	AC	-	-	-	Q/NQ
10	-	Audit Course-II	AC	-	-	-	Q/NQ
11	-	Value Added Course-I	VAC	-	-	-	Q/NQ
12	-	Value Added Course-II	VAC	-	-	-	Q/NQ
Total				09	0	10	14
Total contact hours 19							
SEMESTER II							
1	AGR C104	Fundamentals of Genetics	COR	1	0	2	2
2	AGR C106	Fundamentals of Agricultural Economics	COR	2	0	0	2
3	AGR C108	Fundamentals of Plant Pathology	COR	2	0	2	3
4	AGR C109	Fundamentals of Entomology	COR	2	0	2	3
5	-	Discipline Specific Elective-I	DSE	2	0	2	3
6	-	Discipline Specific Elective-II	DSE	2	0	2	2
7	-	Discipline Specific Elective-III	DSE	2	0	2	2
8	-	Skill Enhancement Course-III	SEC	1	0	2	2
9	-	Skill Enhancement Course-IV	SEC	1	0	2	2

10	-	Audit Course-III	AC	-	-	-	Q/NQ
11	-	Value Added Course-III	VAC	-	-	-	Q/NQ
Total				15	0	16	21
Total contact hours 31							
Cumulative Total				24	0	26	35
SEMESTER III							
1	AGR C202	Fundamentals of Plant Breeding	COR	1	0	2	2
2	AGR C203	Agricultural Finance and Cooperation	COR	1	0	2	2
3	AGR C206	Environmental Studies and Disaster management	COR	1	0	0	1
4	AGR C207	Statistical Methods	COR	1	0	2	2
5	-	Discipline Specific Elective-IV	DSE	1	0	2	2
6	-	Discipline Specific Elective-V	DSE	1	0	2	2
7	-	Skill Enhancement Course-V	SEC	1	0	2	2
8	-	Skill Enhancement Course-VI	SEC	1	0	2	2
9	-	Skill Enhancement Course-VII	SEC	1	0	2	2
10	-	Skill Enhancement Course-VIII	SEC	1	0	2	2
11	-	Value Added Course-IV	VAC	-	-	-	Q/NQ
12	-	Audit Course-IV	AC	-	-	-	Q/NQ
Total				10	0	18	19
Total contact hours 31							
Cumulative Total				34	0	44	54
SEMESTER IV							
1	AGR C211	Farming System & Sustainable Agriculture	COR	1	0	0	1
2	-	Discipline Specific Elective-VI	DSE	2	0	2	3
3	-	Discipline Specific Elective-VII	DSE	1	0	2	2
4	-	Discipline Specific Elective-VIII	DSE	1	0	2	2
5	-	Discipline Specific Elective-IX	DSE	1	0	2	2
6	-	Discipline Specific Elective-X	DSE	2	0	0	2
7	-	Discipline Specific Elective-XI	DSE	1	0	2	2
8	-	Skill Enhancement Course-IX	SEC	1	0	2	2
9	-	Skill Enhancement Course-X	SEC	1	0	2	2
10	-	Skill Enhancement Course-XI	SEC	1	0	2	2
11	-	Innovation Enhancement Course-I	IEC	-	-	2	1

12	-	Value Added Course-V	VAC	-	-	-	Q/NQ
13	-	Value Added Course -VI	VAC				Q/NQ
14	-	Audit Course-V	AC	-	-	-	Q/NQ
Total				12	0	18	21
Total contact hours 30							
Cumulative Total				46	0	62	75
SEMESTER V							
1	AGR C301	Manures, Fertilizers and Soil Fertility Management	COR	1	0	2	2
2	AGR C302	Diseases of Field and Horticultural Crops and their Management –I	COR	2	0	2	3
3	-	Discipline Specific Elective-XII	DSE	1	0	2	2
4	-	Discipline Specific Elective-XIII	DSE	1	0	2	2
5	-	Discipline Specific Elective-XIV	DSE	1	0	2	2
6	-	Discipline Specific Elective-XV	DSE	1	0	0	1
7	-	Discipline Specific Elective-XVI	DSE	1	0	2	2
8	-	Discipline Specific Elective-XVII	DSE	1	0	0	1
9	-	Skill Enhancement Course-XII	SEC	2	0	2	3
10	-	Skill Enhancement Course-XIII	SEC	0	0	4	2
11	-	Innovation Enhancement Course-II	IEC	-	-	2	1
12	-	Value Added Course -VII	VAC	-	-	-	Q/NQ
13	-	Audit Course-VI	AC	-	-	-	Q/NQ
Total				11	0	20	21
Total contact hours 31							
Cumulative Total				57	0	82	96
SEMESTER VI							
1	AGR C305	Rainfed Agriculture & Watershed Management	COR	2	0	0	2
2	AGR C306	Diseases of Field and Horticultural Crops and their Management-II	COR	2	0	2	3
3	-	Discipline Specific Elective-XVIII	DSE	2	0	2	3
4	-	Discipline Specific Elective-XIX	DSE	2	0	2	3
5	-	Discipline Specific Elective-XX	DSE	2	0	2	3
6	-	Skill Enhancement Course-XIV	SEC	1	0	2	2
7	-	Skill Enhancement Course-XV	SEC	0	0	4	2
8	-	Innovation Enhancement Course-III	IEC	-	-	4	2
9	-	Audit Course-VII	AC	-	-	-	Q/NQ

Total				11	0	18	20
Total contact hours 29							
Cumulative Total				68	0	100	116
SEMESTER VII							
1	-	Experiential Learning	REP	0	0	40	20
2	-	Discipline Specific Elective-XXI	DSE	3	0	0	3
3	-	Discipline Specific Elective-XXII	DSE	3	0	2	4
4	-	Discipline Specific Elective-XXIII	DSE	3	0	2	4
5	-	Discipline Specific Elective-XXIV	DSE	3	0	2	3
Total				12	0	46	34
Total contact hours 55							
Cumulative Total				80	0	146	150
SEMESTER VIII							
1	-	Internship Program	IP	0	0	40	20
Total				0	0	40	20
Total contact hours 40							
Grand Total				80	0	186	170
L – Lecture T- Tutorial P- Practical C-Credits							
1L = 1Hr. 1T= 1 Hr. 1P=2 Hr. 1+1C = 1 Hr. of Theory/Tutorial Paper/ week & 2 Hrs. of Practical/ week							

Discipline Specific Elective (DSE): List			
AGR E001	Fundamentals of Plant Biochemistry and Biotechnology	AGR E025	Principles of Integrated Pest and Disease Management
AGR E002	Agricultural Microbiology	AGR E014	Pests of Crops and Stored Grain and their Management
AGR E003	Fundamentals of Crop Physiology	AGR E015	Post-harvest Management and Value Addition of Fruits and Vegetables
AGR E004	Food Safety and Standards	AGR E016	Management of Beneficial Insects
AGR E005	Renewable Energy and Green Technology	AGR E017	Principles of Organic Farming
AGR E026	Application of Drones in Agriculture	AGR E018	Principle of Food Science and Nutrition
AGR E007	Problematic Soils and their Management	AGR E019	Production Technology for Ornamental Crops, MAP and Landscaping
AGR E008	Agri- Informatics	AGR E020	Production Technology for Fruit and Plantation Crops
AGR E009	Introductory Agro-meteorology & Climate Change	AGR E021	Landscaping
AGR E010	Geoinformatics and Nano-technology and	AGR E022	Entrepreneurship Development and Business

	Precision Farming		Communication
AGR E011	Intellectual Property Rights	AGR E023	Protected Cultivation and Secondary Agriculture
AGR E012	Micro- Propagation	AGR E024	Farm Management, Production & Resource Economics

Skill Enhancement Courses (SEC): List

AGR S103	Communication Skills and Personality Development	AGR S209	Crop Production Technology –II (<i>Rabi Crops</i>)
AGR S105	Rural Sociology & Educational Psychology	AGR S210	Principles of Seed Technology
AGR S107	Soil and Water Conservation Engineering	AGR S212	Agricultural Marketing Trade & Prices
AGR S111	Fundamentals of Agricultural Extension Education	AGR S303	Crop Improvement-I (<i>Kharif Crops</i>)
AGR S201	Crop Production Technology – I (<i>Kharif Crops</i>)	AGR S304	Practical Crop Production-I (<i>Kharif crops</i>)
AGR S204	Farm Machinery and Power	AGR S307	Crop Improvement-II (<i>Rabi crops</i>)
AGR S205	Production Technology for Vegetables and Spices	AGR S308	Practical Crop Production –II (<i>Rabi crops</i>)
AGR S208	Livestock and Poultry Management		

Multi-Disciplinary Course (MDC): List

AGR N002	Physical Education**		
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Research Project (REP): List

AGR C403	Internship Program/ Experiential Learning		
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Industrial Practice (IP): List

AGR C404	Internship Program / [RAWE (Rural Agricultural Work Experience)]		
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Value Added Courses (VAC): List

AGR N001	Human Values & Ethics**	SE 004	Social Engineering-IV
SE 001	Social Engineering I	AGR V005	Agripreneurship
SE 002	Social Engineering II	AGR V004	Sericulture
SE 003	Social Engineering III		

Audit Courses (AC): List

SSE 001	Soft Skills Enhancement I	SSE 004	Soft Skills Enhancement IV
SSE 002	Soft Skills Enhancement II	SSE 005	Soft Skills Enhancement V
SSE 003	Soft Skills Enhancement III	SSE 006	Soft Skills Enhancement VI

Remedial Courses (REM): List

AGR R001	Introductory Biology*	AGR R003	Agricultural Heritage
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AGR R002	Elementary Mathematics*		
Innovation Enhancement Courses (IEC): List			
AGR I001	Agriculture Innovation-I	AGR I003	Agriculture Innovation-III
AGR I002	Agriculture Innovation-II		

COURSE DETAILS

Core Courses

Course: Fundamentals of Horticulture

Program	B.Sc. (Hons.) Agriculture	Semester-I			
Course Name	Fundamentals of Horticulture	L	T	P	C
Course Code	AGR C101	1	0	1	2

Course Objectives

This course ensures that the students understand how:

COb1	To know about horticulture, its branches, classification, scopes & importance, various soil and climatic requirement of fruit crops in Uttarakhand and India.
COb2	To study various nursery raising methods, principles of orchard establishment and its management, flower bud differentiation and pollination.
COb3	To study various designs of landscaping, methods of lawn making, the causes of unfruitfulness, kitchen gardening, various factors which affect the growth of vegetables and the use of plant bio-regulators in horticulture.
COb4	To develop entrepreneurial skills through horticultural production and their post-harvest technologies.
COb5	To develop a competitive teaching-learning environment for enabling students for higher studies in the field of horticulture.

Course Outcomes:

Towards the end of the course, the students will be able to:

Sr. No.	Course Outcomes	BT level
CO1	Recall and explain the meaning, scope, importance, and various branches of horticulture, along with soil and climatic requirements of fruit crops in Uttarakhand and India.	L1 and L2
CO2	Demonstrate knowledge of nursery raising methods, orchard establishment principles, and pollination management techniques in fruit crops.	L3
CO3	Analyze various landscaping designs, methods of lawn making, causes of unfruitfulness, and factors affecting vegetable crop growth using plant bio-regulators.	L4

CO4	Evaluate post-harvest technologies and entrepreneurial opportunities in horticultural production for sustainable agribusiness.	L5
CO5	Design innovative horticultural models and research-oriented projects for higher studies and professional development.	L6

Syllabus:

Unit-1		Contact Hours: 03
Horticulture, definition and branches, importance and scope, horticultural and botanical classification, climate, soil and distribution of fruit crops in Indo-gangetic plains and hills of Uttarakhand.		
Unit-2		Contact Hours: 03
Propagation and nursery raising; principles of orchard establishment and management; flower bud differentiation and pollination.		
Unit-3		Contact Hours: 03
Causes of unfruitfulness, pollinizers and pollinators; environmental and soil factors affecting vegetable production, kitchen gardening; garden types and parts.		
Unit-4		Contact Hours: 03
Care and maintenance of ornamental plants, lawn making, knowledge of landscaping of rural and urban areas, exposure to important medicinal and aromatic plants, spices and condiments.		
Unit-5		Contact Hours: 02
Use of plant bio-regulators in horticulture, Post Harvest Technology-Definition, concept, Principles and Practices.		
Practical	Suggested list of Exercises	
1	Identification of various garden tools.	
2	Identification of various horticultural crops.	
3	Preparation of seed bed/nursery bed for fruit and vegetable crops.	
4	To study the various methods of asexual propagation.	
5	Preparation of layout of orchard plants	
6	Planning of planting of orchard plants	
7	Training of fruit trees.	
8	Pruning of fruit trees.	
9	Transplanting and care of vegetable seedlings.	
10	Making of herbaceous and shrubby borders.	
11	To study about various potting mixtures.	

12	To determine potting & repotting.
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Suggestive Readings:

Text Books:

T1. J. Singh (2018) Basic Horticulture, Kalyani Publishers, New Delhi

T2. J.S. Arora, Introductory Ornamental Horticulture, Kalyani Publishers, New Delhi

Reference Books:-

R1. Handbook of Horticulture (Vol.1), ICAR, New Delhi.

R2. Handbook of Horticulture (Vol.2), ICAR, New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	3	1	1	2	2	1	2	1
CO2	2	3	1	2	3	2	1	1	2
CO3	2	3	1	2	2	3	2	1	2
CO4	1	2	3	3	2	2	2	2	3
CO5	1	2	2	3	1	2	3	3	3

Course: Fundamentals of Soil Science

Program	B.Sc. (Hons.) Agriculture	Semester-I			
Course Name	Fundamentals of Soil Science	L	T	P	C
Course Code	AGR C102	2	0	1	3

Course Objectives:

This course ensures that the students understand how:

COb1	Understand various rocks and minerals, and weathering process of soil formation.
COb2	Understand different soil properties and their relationship with crop productivity
COb3	Illustrate the role of soil organic matter for improving soil quality.
COb4	Identify the land suitable for Agriculture based on their land capability classes
COb5	Apply to mitigate soil pollution, and to ameliorate soil acidity and alkalinity

Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	BT level
Co1	Recall the composition of soil and its fundamental relationship with plant growth and development.	L1
Co2	Explain the theoretical and practical concepts of soil physical and chemical properties, including the behavior of soil pH and its influence on nutrient availability.	L2
Co3	Apply appropriate management and control measures to reduce soil acidity and alkalinity, and utilize knowledge to prevent and mitigate soil pollution.	L3
Co4	Identify and differentiate various problematic soils found in India and assess land suitability for agriculture based on land capability classification.	L4
Co5	Evaluate soil taxonomy based on soil survey data and justify the significance of soil information in soil survey, land use planning, and sustainable agricultural development.	L5

Syllabus:

Unit-1		Contact Hours: 05
Soil as a natural body and medium for plant growth; soil compounds and soil plants relationship; soil forming rocks and minerals; Major rocks and minerals of Uttarakhand state; weathering and processes of soil formation.		
Unit-2		Contact Hours: 07
Physical properties of soils – texture, structure, density and porosity, soil colour, consistence and plasticity, soil reaction pH and its measurement, soil acidity and alkalinity, buffering.		
Unit-3		Contact Hours: 06
Effect of pH on nutrient availability, soil colloids – inorganic and organic; silicate clays: constitution and properties; humic substances nature and properties; ion exchange, cation exchange capacity, base saturation.		
Unit-4		Contact Hours: 05
Soil organic matter: composition, properties and influence on soil properties, transformation of organic and inorganic constituents of soil; biological nitrogen fixation; recycling of organic wastes in soils – Urban and industrial wastes.		
Unit-5		Contact Hours: 07
Soil water retention, dynamics and availability; soil air composition and dynamics; source, amount and flow of heat in soils; soil temperature and plant growth; soil survey and classification, soils of Uttarakhand and India; soil pollution – behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution		
Practical	Suggested list of Exercises	
1	Methods of soil sampling and its processing	
2	Determination of soil texture by rapid feel method	
3	Study of soil forming processes	
4	Study of soil structure and soil colour	
5	Measurement of soil moisture by gravimetric method	
6	Determination of the soil pH and EC (electrical conductivity)	
7	Determination of soil organic carbon	
8	Estimation of buffering capacity of soil.	
9	Measurement of particle density, bulk density and porosity of soil	
10	Capillary rise phenomenon of water in soil column and water movement in soil	
11	Determination of electrical charges on soil colloids	
12	Microscopic examination of soil microbes.	

Suggestive Readings:**Text Books:**

T1. Introductory Soil Science by Das Dilip Kumar, Kalyani Publications 2017.

Reference Books:

R1. N.C. Brady, “The Nature and Properties of Soils”, 14th Edition, Dorling Kindersley, 2012

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	2	0	0	1	1	0	1	0
CO2	2	3	0	0	2	2	0	1	0
CO3	1	2	1	2	3	3	1	0	1
CO4	1	2	0	1	2	3	1	0	1
CO5	0	2	1	1	1	2	1	3	3

Course: Fundamental of Agronomy

Program	B.Sc. (Hons.) Agriculture	Semester-I			
Course Name	Fundamental of Agronomy	L	T	P	C
Course Code	AGR C103	2	0	1	3

Course Objectives:

This course ensures that the students understand how:

COb1	Understand the effects of environment on growth and development of plant
COb2	Identify the characteristics of ideal plant type for different crops
COb3	Understand the vital functions of different plants nutrients and their composition in different organic and inorganic fertilizer
COb4	Encourage the students to identify and to manage different weeds found on Agriculture field.
COb5	Understand different soil constraints found in dryland Agriculture and to mitigate their effects.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the scope, concept, principles of Agronomy, and the principles and benefits of Organic Farming in Agriculture.	L1
CO2	Explain different agronomic practices, their methods of application, and the concept and principles of ideotype for various agricultural crops.	L2
CO3	Apply appropriate agronomic practices in farmers' fields to improve crop growth, productivity, and sustainability.	L3
CO4	Identify crop- and soil-related problems and select suitable cropping systems based on soil characteristics and resource availability.	L4
CO5	Evaluate the significance of yield-attributing characters for crop productivity and design suitable crop production models for dryland areas.	L5 & L6

Syllabus:

Unit-1		Contact Hours: 06
Agronomy as a science and its scope, plant growth and development, environmental effects on growth.		
Unit-2		Contact Hours: 09

Ideal plant type (in reference to mountainous region of Uttarakhand, also), tillage, seed quality, sowing, crop density and spatial arrangement, crop nutrition, organic manures and fertilizers, irrigation and drainage.		
Unit-3		Contact Hours: 09
weed management, distribution of crops, cropping systems, selection of crops and varieties for multiple cropping.		
Unit-4		Contact Hours: 09
crop yield contributing characters; Organic farming- concept, practice and scope in India.		
Unit-5		Contact Hours: 09
Crop production in dry lands, Hill region, salt affected, acidic, flood affected, waterlogged and eroded areas.		
Practical	Suggested list of Exercises	
1	Identification and Study of different types of agriculture crops.	
2	Study of Morphological characteristic of Rice plant in field.	
3	Identification of agricultural tools and implements and their working in fields.	
4	Study of working of primary tillage implements in fields.	
5	Demonstration of different sowing methods of crops in agriculture field.	
6	Demonstration of different irrigation methods in field.	
7	Identification and demonstration of different types of fertilizers and organic manure.	
8	Identification of seeds of different agriculture crops.	
9	Identify the major weed of kharif season in field.	
10	Calculation of doses of different types of fertilizers.	
11	Identify the major weed of rabi season in field.	
12	Visit of nearby KVK.	

Suggestive Readings:

Text Books:

T1: Fundamentals of Agronomy by Gopal Chandra De, Oxford & IBH Publishing, 2013.

T2: Introductory Soil Science by Dilip Kumar Das, Kalyani Publications, 2015.

Reference Books:

R1. "Handbook of Agriculture", ICAR, New Delhi, Sixteenth Reprint of Sixth Edition, 2021

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	1	0	1	0	0	1	0
CO2	2	3	0	0	2	1	0	0	0
CO3	1	2	1	2	3	3	1	0	1
CO4	1	2	0	1	2	3	1	0	1
CO5	1	2	0	2	2	2	1	1	3

Course: Fundamentals of Genetics

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Genetics	L	T	P	C	Course Type
Course Code	AGR C104	1	0	1	2	COR

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce classical and modern concepts of heredity including Mendelian and post-Mendelian genetics.
COb2	To explain cell structure, chromosome organization, cell division, and chromosomal variations.
COb3	To impart knowledge on gene interactions, linkage, chromosome mapping, and chromosomal aberrations.
COb4	To familiarize students with molecular basis of heredity including replication, transcription, translation, and gene regulation.
COb5	To develop understanding of mutations, extranuclear inheritance, quantitative inheritance, and basics of plant tissue culture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain Mendelian and post-Mendelian concepts of heredity, probability principles, and chi-square analysis.	L2	Mid Term
CO2	Describe cell structure, chromosome organization, cell division (mitosis and meiosis), and special chromosomes.	L2	Mid Term
CO3	Analyze gene interactions, dominance relationships, linkage, crossing over, chromosome mapping, and chromosomal aberrations.	L4	Case Studies/ Project/ Assignment
CO4	Explain molecular basis of heredity including DNA structure, replication, transcription, translation, and gene regulation mechanisms.	L2	Practical Examination
CO5	Evaluate the role of mutations, extranuclear inheritance, quantitative inheritance, and plant tissue culture in crop improvement.	L5	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
History: Pre mendelian and post-Mendelian concepts of heredity, mendelian principles of heredity, Probability and chi-square.		
Unit-2		Contact Hours: 3
Cell plant cell and animal cell, chromosome structure. Cell division mitosis, meiosis, variation in chromosomes polytene chromosome, Lampbrush chromosomes. Dominance relationship gene interaction.		
Unit-3		Contact Hours: 3
Multiple alleles, pleiotropism and pseudoalleles. Sex determination and sex linkage, sex limited and sex influenced traits. Linkage, Crossing over mechanism, Chromosomes mapping, structural changes in chromosomes: Deletion and Duplication, Translocation and diversion, "Numerical changes in chromosomes, chemical basis of heredity".		
Unit-4		Contact Hours: 3
Gene concept made of replication of genetic material, transcription and translational mechanism of genetic material. Gene regulation and operon concept.		
Unit-5		Contact Hours: 3
Mutations: chemical and physical mutagens, mode of action of mutagens. Extranuclear inheritance. Polygene and quantitative inheritance. Introduction to plant tissue culture.		
Practical	Suggested list of Exercises	
1	To learn the different parts of a Simple and compound microscope	
2	To learn the Monohybrid cross and test cross	
3	To learn the Dihybrid cross and test cross	
4	To learn the procedure of Back cross	
5	To learn the Epistatic interactions in different plant species	
6	To study the different stages of Mitosis Cell division in Onion root tips	
7	To learn the different stages of Meiosis Cell division in Onion root tips	
8	To know the different special types of chromosome	
9	To perform exercise on Probability and chi-square	
10	To learn the procedure of Linkage and crossing over	
11	To perform exercise on Linkage analysis, three point test cross	
12	To know the Sex linked inheritance	

- **Books:**

Textbooks: -

T1. P.K. Gupta Genetics, Rastogi Publication Meerut.

T2. B.D. Singh Fundamentals of Genetics by, Kalyani Publishers, Ludhiana.

T3. Chandrasekharan, S.N. and Parthasarthy Cytogenetics and Plant Breeding by, P. Vardachary & Co, 8, Linghi chatty street, Madras.

Reference Books: -

R1. Stick Berger, Genetics. H.W., McMillan Co. New York.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

- **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	0	0	0	1
CO2	3	1	0	0	0	0	0	0	0
CO3	2	3	1	1	0	0	0	0	0
CO4	3	2	0	0	1	0	0	0	0
CO5	2	3	3	0	2	2	1	0	2

Course: Fundamentals of Agricultural Economics

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Agricultural Economics	L	T	P	C	Course Type
Course Code	AGR C106	2	0	0	2	COR

• **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the nature, scope, subject matter, and analytical approaches of economics with emphasis on agricultural context.
COb2	To explain fundamental concepts of demand, supply, utility, production, cost, and market structures.
COb3	To develop understanding of national income, population dynamics, money, banking, inflation, and economic systems.
COb4	To impart knowledge on international trade theories, exchange rate mechanisms, balance of payments, and recent global trade developments.
COb5	To familiarize students with the role of agriculture, women in agriculture, and agricultural planning in Indian and Uttarakhand economic development.

• **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the nature, scope, basic concepts of economics, laws of demand, elasticity of demand, and their applications.	L2	Mid Term
CO2	Explain consumer behavior, utility analysis, production relationships, laws of returns, and scale economies.	L2	Mid Term
CO3	Analyze cost concepts, supply behavior, market equilibrium, and price determination under different market structures.	L4	Case Studies/ Project/ Assignment
CO4	Explain concepts of national income, population theories, money, banking system, inflation, and credit control mechanisms.	L2	Practical Examination
CO5	Evaluate the role of international trade, economic systems, agricultural planning, and agriculture (including women's role) in Indian and Uttarakhand economic development.	L5	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
Nature, scope and subject matter of economics, approaches to economic analysis and nature of economic theory, basic terms and concepts; law of demand, determinants of demand, price, cross price and income elasticity of demand and their applications.		
Unit-2		Contact Hours: 3
Law of diminishing marginal utility and principle of equi-marginal utility, consumer's equilibrium and derivation of demand curve; factors of production and input-output relationships, law of variable proportions and laws of scale.		
Unit-3		Contact Hours: 3
Cost concepts, law of supply, determinants of supply, elasticity of supply; firm's equilibrium and market equilibrium in short run and long run; features of perfectly competitive market, price determination under perfect competition, basic features of monopoly, duopoly, oligopoly and monopolistic competition meaning of distribution, factor market and pricing of factors of production.		
Unit-4		Contact Hours: 3
Importance of national income, concepts of national income, approaches of measuring national income, difficulties and limitations of national income accounting; importance of population studies, determinants of population, theories of population; barter system of exchange and its problems, classification of money and concepts of money supply, quantity theory of money.		
Unit-5		Contact Hours: 3
GPT, inflation, deflation role of bank money in modern economy, types of banks and their function, credit creation by commercial banks, functions of central bank and instruments of credit control, current changes in banking; concept of economy and economic system, basic feature of capitalistic, socialistic and mixed economic systems, elements of economic planning; international trade, its need and importance, theories of absolute and comparative advantage, exchange rate, TOT, BOP, devaluation of infancy, recent developments in world trade. Special characteristics of Uttarakhand and Indian agriculture and its role in economic development, agricultural planning and development in the country. Role of women in Indian Agriculture.		

• **Books:**

Textbooks: -

T1. Dewett, K.K. Modern Economic Theory, B.Chand & Co., New Delhi.

T2. Subba Reddy S., Raghu Ram P., Neelkanta Sastry, T.V., Bhavani Devi I. Agricultural Economics.

Reddy, Ram, Shastri & Devi. Oxford & IBHPublishing Co. Pvt. Ltd., New Delhi

Reference Books: -

R1. Randall, Allan. Resource Economics – An Economic Approach to Natural Resources and Environmental Policy, Grid Publishing, Inc. Columbus, Ohio.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination						
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	0	0	0	1
CO2	3	2	0	0	0	0	0	0	0
CO3	2	3	1	0	0	0	0	0	0
CO4	2	2	0	0	0	0	0	0	0
CO5	2	3	3	0	0	2	1	1	2

Course: Fundamentals of Plant Pathology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Plant Pathology	L	T	P	C	Course Type
Course Code	AGR C108	2	0	1	3	COR

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the definition, scope, history, terminology, and basic concepts of plant pathology.
COb2	To impart knowledge on plant pathogens, their classification, nomenclature, survival, dispersal, infection, and pathogenesis.
COb3	To explain host–pathogen interactions and structural and biochemical defense mechanisms in plants.
COb4	To develop understanding of plant disease epidemiology, forecasting, quarantine, and regulatory measures.
COb5	To familiarize students with principles and methods of plant disease management including cultural, biological, chemical, physical methods, host resistance, and integrated disease management (IDM).

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the definition, objectives, history, terminology, and basic concepts of plant pathology, including survival and dispersal of plant pathogens.	L2	Mid Term
CO2	Describe different groups of plant pathogenic organisms, their classification, nomenclature, and general characteristics with examples of diseases caused.	L2	Mid Term
CO3	Explain the processes of infection, pathogenesis, host–pathogen interactions, and structural and biochemical defense mechanisms in plants.	L2	Case Studies/ Project/ Assignment
CO4	Analyze plant disease epidemiology, forecasting methods, quarantine principles, and regulatory measures for disease prevention.	L4	Practical Examination
CO5	Apply principles and methods of plant disease management including cultural, biological, physical, chemical control, host plant resistance, and integrated disease management (IDM).	L3	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
Introduction: Definition and objectives of Plant Pathology. History, terms and concepts in Plant Pathology. Survival and Dispersal of Plant Pathogens. Phenomenon of infection – pre-penetration, penetration and post penetration. Pathogenesis. Defense mechanism in plants– Structural and Bio-chemical (pre and post-infection). Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them.		
Unit-2		Contact Hours: 3
Nomenclature, Binomial system of nomenclature, rules of nomenclature. Classification of fungi and bacteria. Key to divisions and sub-divisions.		
Unit-3		Contact Hours: 3
General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual).		
Unit-4		Contact Hours: 3
Plant disease epidemiology. Plant Disease Forecasting – Remote sensing – General principles of plant diseases management –Importance, general Principles – Avoidance, exclusion, protection – Plant Quarantine and Inspection – Quarantine Rules and Regulations.		
Unit-5		Contact Hours: 3
Cultural methods – Rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather plugging, soil amendmets, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR. Physical Methods – Heat and Chemical methods – Methods of application of fungicides. Host plant resistance. Integrated plant disease management (IDM) – Concept, advantages and importance.		
Practical	Suggested list of Exercises	
1	To get acquaintance with various phytopathological instruments used in Lab.	
2	To study the various parts of microscope and its uses.	
3	Preparation of PDA (Potato Dextrose Agar) media for isolation process	
4	To study isolation process of diseased samples from leaf.	
5	To study various fungicidal applications used in the field to control plant diseases	
6	To study the seed treatment process with fungicides to control plant diseases	
7	To know different companies manufacturing the various fungicides with their trade names.	
8	Identification of fungal plant diseases from the field	

9	Identification of bacterial plant diseases from the field
10	Identification of viral plant diseases from the field
11	Collection and preservation of diseased samples in the herbarium
12	To study different chemical formulations.

• **Books:**

Textbooks: -

T1. P.K. Gupta Genetics, Rastogi Publication Meerut.

T2. Kalita Manoj Kumar. Fundamental of plant pathology Kalyani Publishers.

Reference Books: -

R1.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	0	0	0	1
CO2	3	2	0	0	0	0	0	0	0
CO3	3	2	0	0	0	1	0	0	0
CO4	2	3	2	0	0	2	3	0	0
CO5	2	3	3	0	1	3	1	1	0

Course: Fundamentals of Entomology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Entomology	L	T	P	C	Course Type
Course Code	AGR C109	2	0	1	3	COR

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the scope, history, and importance of entomology with emphasis on insects in agriculture.
COb2	To explain the origin, evolution, dominance, and taxonomic position of insects within Arthropoda.
COb3	To impart knowledge on external morphology, internal anatomy, and physiological systems of insects using grasshopper as a model.
COb4	To familiarize students with insect development, sensory organs, and endocrine system.
COb5	To develop the ability to identify major insect orders and families of agricultural importance

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the scope of entomology, history of entomology in India, origin, evolution, and dominance of insects in the animal kingdom.	L2	Mid Term
CO2	Describe the taxonomic position of insects within Arthropoda and their relationship with Annelida and other arthropod classes.	L2	Mid Term
CO3	Explain the external morphology and internal anatomy of grasshopper, including body systems and sensory organs.	L2	Case Studies/ Project/ Assignment
CO4	Describe insect embryology, post-embryonic development, metamorphosis, and role of endocrine glands.	L2	Practical Examination
CO5	Identify and classify major insect orders and families of agricultural importance based on diagnostic characters.	L3	End Term Examination

Syllabus:

Unit-1		Contact Hours: 2
The scope of Entomology, brief history of entomology in India, insects as Arthropods and its relationship		

with phylum Annelida and other classes of Arthropoda, origin in insects major points related to dominance of insects in Animal Kingdom.

Unit-2		Contact Hours: 3
External morphology and anatomy of grass hopper; body segmentation, integument, thorax and abdomen, antennae, legs and wings and their modifications, generalized mouth parts and their modifications, Alimentary, Circulatory, Excretory, Respiratory, Reproductive and nervous systems, major sensory organs like simple and compound eyes chemoreceptors, endocrine glands; basic embryology and post embryonic development		
Unit-3		Contact Hours: 3
Basic groups of present day insects with special emphasis to orders and families of agricultural importance like Orthoptera; Tetigonidae, Gryllidae, Gryllotalpidae, Acrididae, Dictyoptera; Mantidae, Blattidae; Isoptera; Hemiptera; Pentatomidae; Coreidae; Cimicidae, Cicadellidae, Delphacidae, Lophophidae.		
Unit-4		Contact Hours: 3
Basic groups of present day insects with special emphasis to orders and families of agricultural importance like Coleoptera. Carabidae, Meloidae, Coccinellidae, Bruchidae, Chrysomelidae, Curculionidae, Cerambycidae; Diptera; Culicidae Cephritidae; Agromyzidae, Muscidae;		
Unit-5		Contact Hours: 3
Basic groups of present day insects with special emphasis to orders and families of agricultural importance like Lepidoptera, Pteridae; Papilionidae, Hespirlidae, Sphingidae, Noctuidae, Artilidae, Pyralidae, Saturnidae, Bombycidae; Hymonoptera. Tenthredinidae, Braconidae, Chalcididae, Trichogrammatidae.		
Practical	Suggested list of Exercises	
1	To get acquaintance with various entomological instruments with their uses which are present in the laboratory	
2	To study different classes of phylum Arthropoda	
3	Collection of insects from the field in the insect box	
4	To study the killing process of insect	
5	To study the pinning process in insect	
6	To study the mounting process in insect	
7	To study various chemical formulations	
8	To study different insecticidal applications in the field	
9	To know different insecticides and companies manufacturing them	
10	To study the seed treatment process with insecticides	
11	To study external morphology of grasshopper	

12	To study different types of leg in insect
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• **Books:**

Textbooks: -

T1. Richards, D.W. and Davis, E.C, General Text Book of Entomology

T2. Mathur and Upadhayay Agricultural Entomology

Reference Books: -

R1. P.K. Sehgal, Fundamentals of Agricultural Entomology Kalyani Publishers. New Delhi

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	1	0	0	1
CO2	3	1	0	0	0	0	0	0	0
CO3	3	2	0	0	0	0	0	0	0
CO4	2	1	0	0	0	0	0	0	0
CO5	2	3	2	0	1	2	0	1	0

Course: Fundamentals of Plant Breeding

Program	B.Sc. (Hons.) Agriculture	Semester				III
Course Name	Fundamentals of Plant Breeding	L	T	P	C	Course Type
Course Code	AGR C202	1	0	1	2	CORE

Course Objectives:

The major objectives of the course are

COb1	Make the students list the historical development of plant breeding and its significance.
COb2	Enable students to understand the concepts and principles of plant breeding.
COb3	To apply and design ethical breeding objectives for further development of varieties with desired quality for yield, adaptability and resistance towards biotic and abiotic stresses.
COb4	Select appropriate breeding methods of crop improvement in sexually and asexually propagated crop plants.
COb5	Assess the potential impact of biotechnology and other emerging technologies on future crop improvement.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and explain the fundamental terms, concepts, history, and major achievements of Plant Breeding.	L1
CO2	Classify and compare the modes of reproduction and methods of crop improvement in self-pollinated and cross-pollinated crop species.	L2
CO3	Apply breeding objectives, prioritize desirable traits, and calculate changes in gene frequency for trait improvement in crop plants.	L3
CO4	Analyze modern tools, techniques, and experimental designs used in crop improvement programs.	L4
CO5	Evaluate and plan future strategies, technologies, and alternative methods for varietal improvement beyond traditional breeding approaches.	L5

Syllabus:

Unit-1		Contact Hours: 05
Historical development of plant breeding plant breeding concept, nature and role of plant breeding, major achievements and future prospects, genetics in relation to plant breeding, modes of reproduction, self incompatibility and male sterility. Domestication, centers of origin, centers of diversity, acclimatization and components of genetic variation and heritability.		
Unit-2		Contact Hours: 06
Crop systematic, species relationship, floral biology and inheritance of economically important characters, breeding objectives development of varieties with desired yield, adaptability, stability, disease and pest resistance and quality (Physical, chemical, nutritional) and marketing Important varieties along with parentage and characteristics.		
Unit-3		Contact Hours: 06
Breeding methods in self pollinated crops: Introduction, selection, pure line theory, hybridization techniques and handling of segregating populations; Hardy-Weinberg law; Methods of breeding of cross pollinated crops; System of mating, heterosis and inbreeding depression, development of inbred lines and hybrids and synthetic varieties.		
Unit-4		Contact Hours: 06
Breeding methods in asexually propagated crops, clonal selection and hybridization; Polyploidy in relation to plant breeding, Mutation breeding methods, mutagenic agents, induced mutation in plant breeding; Breeding for important biotic and abiotic stresses, and use of biotechnology in plant breeding, procedure for release of new plant varieties.		
Unit-5		Contact Hours: 05
Future thrust area in varietal improvement in crops like wheat, rice, maize, soybean, field pea, pigeon pea, urd bean, rapeseed-mustard, sunflower, groundnut, sorghum, sugarcane, potato, cotton and tobacco.		
Practical	Suggested list of Exercises	
1	To know the Floral structure and biology of self-pollinated crops	
2	To know the Floral structure and biology of cross pollinated crops	
3	To perform Emasculation in Self Pollinated crops	
4	To perform Emasculation in Cross Pollinated crops	
5	To understand the concept of variation and selection in field condition	
6	To understand the Important designs used in plant breeding experiments	
7	To estimate heterosis and inbreeding depression in crops	
8	To understand the methods of calculating mean, range, variances, standard variation	
9	To know the Layout of field experiments in plant breeding	

10	To learn the Induction of mutation through chemical mutagens
11	To know the prediction of performance of double cross hybrids through single cross hybrids
12	Development of hybrid seed through crossing

Suggestive Readings:

Text Books:

T1. B.D.Singh. Plant Breeding. Kalyani Publishers, New Delhi.

Reference Book:

R1. Phundan Singh. Essentials of Plant Breeding. Kalyani Publishers, New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	3	1	0	1	0	0	1	0
CO2	2	3	1	1	2	2	1	1	0
CO3	2	3	1	2	3	3	1	1	2
CO4	1	3	2	2	2	3	2	2	2
CO5	1	3	3	3	2	3	3	3	3

Course: Agriculture Finance & Cooperation

Program	B.Sc. (Hons.) Agriculture	Semester				III
Course Name	Agriculture Finance & Cooperation	L	T	P	C	Course Type
Course Code	AGR C203	1	0	1	2	CORE

Course Objectives:

This course ensures that the students understand how:

COb1	Understand the need, importance, scope of accounting and finance in agriculture business.
COb2	Understand various sources providing agricultural finance, procedures and considerations
COb3	Understand the role, functioning, structure of RBI, NABARD, Commercial banks, RRB's and their inter relationship.
COb4	To understand the concept of cooperation in agriculture, their types and knowledge of major cooperatives at different levels, operating in different specialized areas of agriculture.
COb5	Understand the scope and potential of Agribusiness along with fundamentals of anagement.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the basic concepts of finance, capital, factors of production, and the functions and roles of major financial and cooperative institutions in the country.	L1
CO2	Explain the importance of cooperatives, agribusiness, and agricultural finance in improving business capacity, competitiveness, and rural development.	L2
CO3	Identify and apply knowledge of various financial institutions, cooperatives, and funding sources for financing agricultural projects, enterprises, and start-ups.	L3
CO4	Analyze balance sheets and other financial statements and interpret basic principles of agribusiness management and decision-making.	L4
CO5	Evaluate the role of agricultural finance and management practices in promoting sustainable agribusiness development, gender equality, and women's empowerment.	L5 & L6

Syllabus:

Unit-1		Contact Hours: 15
Cooperation-Meaning, significance under Indian agricultural conditions, objectives principles of cooperatives. Agricultural cooperation in India credit, marketing, consumer and multi- purpose cooperatives, farming cooperatives, processing cooperatives, cooperative warehousing, role of ICA, NCU, NCDC, NAFED etc. women cooperatives.		
Unit-2		Contact Hours: 05
Cooperation-Meaning, significance under Indian agricultural conditions, objectives principles of cooperatives. Agricultural cooperation in India credit, marketing, consumer and multi- purpose cooperatives, farming cooperatives, processing cooperatives, cooperative warehousing, role of ICA, NCU, NCDC, NAFED etc. women cooperatives.		
Unit-3		Contact Hours: 05
Access for women to agricultural credit facilities. Agricultural credit market- institutional and non-institutional sources of credit, cooperatives credit system, commercial banks and regional rural banks, NABARD and AFC, problems and issues in institutional agricultural credit system.		
Unit-4		Contact Hours: 15
Business management environment of agricultural business, tasks of a professional manager, management system and processes		
Unit-5		Contact Hours: 05
Types of management decisions, decisions, decision making techniques and processes, organizational culture and management ethics.		

Suggestive Readings:**Text Books:**

T1. Reddy, Ram, Shastri & Devi, Agricultural Economics, Oxford & IBH PUB. Co. Pvt. Ltd. New Delhi.

References Book:

R1. A Hand Book of Agricultural. ICAR Publication, New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case	<input checked="" type="checkbox"/>		05			Levels 1 to 5

Studies/ Project						
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	0	3	1	1	0	0	1	1	0
CO2	0	3	2	2	1	1	2	1	1
CO3	0	2	2	3	1	2	3	1	3
CO4	0	3	2	3	1	3	2	2	3
CO5	0	2	3	3	1	2	2	2	3

Course: Environmental Studies and Disaster Management

Program	B.Sc. (Hons.) Agriculture	Semester				III
Course Name	Environmental Studies and Disaster Management.	L	T	P	C	Course Type
Course Code	AGR C206	1	0	0	1	CORE

Course Objectives:

This course ensures that the students understand how:

COb1	Recall and understand the fundamental concepts of environmental science and disaster management.
COb2	Explain the various environmental processes and the impact of human activities on the environment, including the causes and consequences of natural and man-made disasters.
COb3	Apply modern technology and scientific methods in solving environmental and disaster-related problems, focusing on the needs and challenges faced by the farming community.
COb4	Analyze environmental data and disaster scenarios to develop effective management and mitigation strategies.
COb5	Design and plan independent projects that address specific environmental and disaster management issues, incorporating ethical integrity and entrepreneurial skills.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and recall key terms and fundamental concepts of Environmental Science, including its multidisciplinary nature, scope, and importance.	L1
CO2	Explain the need for public awareness, the role of individuals in environmental protection, and core ecological concepts such as ecosystems, natural resources, energy flow, and trophic levels.	L2
CO3	Apply principles of natural resource conservation to assess issues related to surface and groundwater use, over-exploitation, modern agricultural practices, and their impacts on food security and environmental sustainability.	L3
CO4	Analyze environmental problems arising from mineral resource extraction, biodiversity loss, pollution (air, water, noise, marine, thermal, radioactive), and evaluate biodiversity values (5 Es) with reference to India as a mega-diversity nation and regional issues such as limestone quarrying in Uttarakhand.	L4
CO5	Evaluate conservation strategies (in-situ and ex-situ), disaster management approaches, and environmental hazard mitigation practices in sensitive ecosystems like the Himalayas, integrating scientific methods with traditional ecological knowledge..	L5 & L6

Syllabus:

Unit-1		Contact Hours: 07
Definition, scope and importance (the multidisciplinary nature of environmental sciences). Need for public awareness on Environment, Role of individual in Environmental protection. Natural Resource conservation: concepts. Freshwater resources: use and over-exploitation of surface and ground water, conflict over water, hydroelectric projects, problems, traditional methods of harvesting of freshwater resources.		
Unit-2		Contact Hours: 05
Mineral resources: use and exploitation, environmental effects of extracting mineral resources, Lime stone quarrying in Uttaranchal. Food resources: World food problems, changes caused by agriculture and overgrazing, effect of modern agriculture, fertilizer operated problem, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.		
Unit-3		Contact Hours: 06
Land resources: Land as a resources, land degradation, landslides, soil erosion and desertification. Concept, structure, and components of an ecosystem. Abiotic and biotic variables. Ecosystem function, trophic levels, energy flow, food chain, food web, Ecosystem, homeostasis. Examples of ecosystems (aquatic: pond, lake, river). Terrestrial ecosystem: Forest, mountain. Ecological succession. Introduction:- Definition, genetic, species and ecosystem diversity. Bio-geographical classification of India. Values of biodiversity: 5 Es (Esthetic (Aesthetic), Economic, Environment, Ethical, Emotional. Biodiversity at global, national and local levels. India as a mega diversity nation, hot spots of biodiversity.		
Unit-4		Contact Hours: 06
Himalayan wildlife: Habitat loss, poaching of wildlife, man-wildlife conflicts, and conservation. Threatened categories as per IUCN. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Definition, causes, effects and measures of Air pollution. Water pollution and thermal pollution. Marine pollution. Noise and radioactive pollution. Solid waste and their management (municipal, industrial (hazardous and non-hazardous), problems of solid waste disposal in Uttaranchal and integrated Solid Waste Management (ISWM).Environmental hazards in Himalayas (floods, river, blockades, cloud burst, landslides, earthquakes). Anthropogenic and natural environmental problems. Environmental ethics; issues and possible solutions. Climate change, global warning: causes, effects and mitigation (national and international efforts). environmental problems. Environmental ethics; issues and possible solutions. Climate change, global warning: causes, effects and mitigation (national and international efforts).		
Unit-5		Contact Hours: 08
Ozone layer depletion: causes, effects and mitigation. (national and international). Environmental Protection Act 1986. Air (Prevention and Control of pollution) Act, Water (Prevention and control of Pollution) Act.Wildlife Protection Act 1972. Forest Conservation Act 1980. The Biological Diversity Act 2002. Issues involved in enforcement of environmental legislation, public awareness, Article 48A and 51A. Automobile Emission standards (Eco/Bharat), Ecomark.Population growth, variation among nations, population explosion Family Welfare Programme.Environment and human health.Role of Information Technology in environment and human health. Definition, concepts and currencies .Sustainable development of agro-ecosystem (organic farming). Sericulture, floriculture, bee keeping. Sustainable development of hydroenergy in Uttarakhand. Traditional Ecological knowledge (TEK) Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, 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; Disaster response; Police and other organizations.

Suggestive Readings:

Text Books:

T1. Text book & Environmental studies (UGC, Universities press) –Erach Bharucha.

T2. Principles and practices of silviculture – L.S. Khanna.

T3. Silvicultural systems – Ramprakash& L.S. Khanna.

T4. Ecology – E.P. Odum

T5. Biodiversity & Sustainable Conservation- Darshan Kumar.

T6. Environmental Pollution and Management – P.C. Trivedi

T7. Hand book of Forestry – A.P. Dwivedi.

Reference books:

R1. Ecology, Environment and Resource Conservation J.S. Singh, S.P. Singh & S.R. Gupta.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	☑	2hr	40			Levels 1 to 2
Assignment/ Case Studies/ Project	☑		05			Levels 1 to 5
Surprise Quiz	☑	10mins	05			Level 1
End term Examination	☑	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	3	2	0	1	1	0	1	0
CO2	1	3	3	1	2	2	1	1	0
CO3	2	3	2	2	3	3	1	1	2
CO4	1	3	3	2	2	3	2	2	2
CO5	1	3	3	3	2	3	2	2	3

Course: Statistical Methods

Program	B.Sc. (Hons.) Agriculture	Semester				III
Course Name	Statistical Methods	L	T	P	C	Course Type
Course Code	AGR C207	1	0	1	2	CORE

Course Objectives:

This course ensures that the students understand how:

COb1	To know the principles and methods of statistical calculations used in agriculture.
COb2	To study the statistical methods of analysis of data viz. quartile deviation, mean deviation, variances, standard deviation, coefficient of variation, moments, including skewness, Kurtosis and its measure.
COb3	To understand the statistical methods in collection of any type of data, classification of data, Presentation of data, analysis of data, descriptive statistics, parametric and non-parametric tests, etc.
COb4	To Analyze and make statistical hypothesis and design experiment in agriculture.
COb5	To develop the ability to Correlate the results of statistical calculations and their validation with the available agricultural data.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Identify and define the measures of central tendency and basic statistical terms used in agricultural data analysis.	L1
CO2	Classify agricultural data into qualitative and quantitative types and explain the importance of variability measures, including the coefficient of variation.	L2
CO3	Apply statistical measures such as standard deviation and other descriptive statistics to analyze data related to crop production and agricultural experiments.	L3
CO4	Analyze and compare correlation and regression techniques for interpreting relationships among variables in agricultural research experiments.	L4
CO5	Evaluate experimental results using levels of significance and appropriate statistical methods to draw valid conclusions and support decision-making in agricultural problem solving.	L5 & L6

Syllabus:

Unit-1		Contact Hours: 03
Introduction to statistics, arithmetic mean, median, mode and partition values range.		
Unit-2		Contact Hours: 05
Interquartile range, quartile deviation, mean deviation, variances, standard deviation, coefficient of variation, moments, skewness, Kurtosis and its measure.		
Unit-3		Contact Hours: 05
Definition of probability. Simple problems based on probability theory.		
Unit-4		Contact Hours: 05
Definition of correlation; Scatter diagram; Karl pearson's coefficient of correlation; Linear regression equations.		
Unit-5		Contact Hours: 05
Introduction to test of significance, one sample and two sample test for mean.		

Practical	Suggested list of Exercises
1	Exercise on Mean, Median, mode
2	Exercise on Inter Quartile Deviation
3	Exercise on Quartile Deviation
4	Exercise on Variance
5	Exercise on Co-Variance
6	Exercise on Skewness and Kurtosis
7	Problems on Probability
8	Problems on Correlation.
9	Problem on Linear Regression equations (with Graph)
10	Problem on t-Test
11	Problem on f-Test
12	Problem on z-Test

Suggestive Readings:**Text Books:**

T1. Dr. SRS Chandel. Agricultural Statistics Impact Printing Press, Kanpur.

T2. Prof. Abhijit Sharma, Assam Agriculture University: Agricultural Statistics, Kalyani Publishers

Reference Books:

R1. Prof. Rangasawamy: A Text Book of Agricultural Statistics, New Age Publications

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	0	0	1	1	0	1	0
CO2	1	3	0	0	1	2	0	1	0
CO3	2	3	1	1	3	3	1	1	2
CO4	1	3	1	2	2	3	2	2	2
CO5	1	3	2	3	2	3	2	2	3

Course: Manures, Fertilizers and Soil Fertility Management

Program	B.Sc. (Hons.) Agriculture	Semester				V
Course Name	Manures, Fertilizers and Soil Fertility Management	L	T	P	C	Course Type
Course Code	AGR C301	1	0	1	2	CORE

Course Objectives:

This course ensures that the students understand how:

COb1	To become knowledgeable about the various organic manures and their role in maintaining ecological balance.
COb2	To comprehend the issues around chemical fertilisers and determine the best fixes.
COb3	To disseminate knowledge regarding the traditional processes those underpin nitrogen transfer from the soil to plants and the atmosphere and preserve soil fertility.
COb4	To equip students with the skills necessary for soil testing, evaluating soil fertility, and providing advice on crop fertilisation.
COb5	To create a challenging environment for teaching and learning that will prepare students for advanced work in the field of soil science.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the fundamentals of organic manures, bulky and concentrated manures, green manuring practices, integrated nutrient management, and basic concepts of soil fertility.	L1
CO2	Explain the composition, characteristics, and manufacturing processes of major nitrogenous, phosphatic, and potassic fertilizers, including secondary, micronutrient, complex, nano-fertilizers, soil amendments, and the Fertilizer Control Order with reference to organic farming initiatives in Uttarakhand.	L2
CO3	Apply knowledge of soil nutrient chemistry to interpret nutrient transport mechanisms, deficiency and toxicity symptoms, self-regeneration of soil fertility, and the behavior of macro- and micronutrients in soils.	L3
CO4	Analyze soil nutrient status using critical limits, indicator plants, and standard soil testing methods and protocols, and examine factors influencing nutrient availability and nutrient use efficiency.	L4

CO5	Design sustainable fertilizer recommendation strategies and nutrient application plans for rainfed and irrigated cropping systems by integrating nutrient management approaches, fertilizer dosage methods, and principles of nutrient use efficiency (NUE).	L5 & L6
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Syllabus:

Unit-1		Contact Hours: 5
Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.		
Unit-2		Contact Hours: 6
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.		
Unit-3		Contact Hours: 6
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. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.		
Unit-4		Contact Hours: 6
Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants.		
Unit-5		Contact Hours: 5
Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.		
Practical	Suggested list of Exercises	
1	Principle and application of colorimetry	
2	Principle and application of flame photometry	
3	Estimation of soil organic carbon	
4	Determination of the soil pH and EC (electrical conductivity)	
5	Estimation of available nitrogen in soil by alkaline permanganate method (Subbiah & Asija, 1956)	
6	Estimation of available phosphorus content in soil (Olsen's method)	
7	Estimation of available potassium using flame photometer	
8	Estimation of soil extractable sulphur in soil	
9	Estimation of total nitrogen from plant sample	
10	Estimation of total phosphorus from plant sample	

11	Estimation of total potassium from plant sample
12	Estimation of sulphur from plant sample

Suggestive Readings:

Text Books:

T1. Test book of Soil Science by R.K. Mehra, Indian Council of Agricultural Research, New Delhi.

T2. Introductory Soil Science by D.K Das, Kalyani Publishers.

T3. Soil Fertility and Fertilizers Use by John L. Havin, Samuel L. Tisdale, Werner L. Nelson, and James D. Beaton, PHI Learning Private Limited.

T4. Fundamentals of Soil Science by Indian Society of Soil Science.

Reference books:

R1. Principles of Agronomy by T.Yellamanda and G.H. Sankara Reddy, Kalyani Publishers.

R2. Nature and Properties of Soils by NC Brady, Pearson Education India.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	1	0	2	1	0	1	0
CO2	2	3	2	1	2	1	1	1	0
CO3	2	3	1	1	3	2	1	0	1
CO4	2	3	1	1	3	3	1	0	2
CO5	3	3	2	3	3	3	2	1	3

Course: Diseases of Field and Horticultural Crops and their Management –I

Program	B.Sc. (Hons.) Agriculture	Semester				V
Course Name	Diseases of Field and Horticultural Crops and their Management –I	L	T	P	C	Course Type
Course Code	AGR C302	2	0	1	3	CORE

Course Objectives:

This course ensures that the students understand how:

COb1	Recall the major diseases of field and horticultural crops of Kharif season.
COb2	Classify the major fungal, bacterial and viral diseases of field crops, oilseeds and pulses grown in the Kharif season.
COb3	Identify the symptoms, etiology, disease cycle and management practices of major diseases of field and horticultural crops grown in the Kharif season.
COb4	Apply the knowledge to carry out the best management practices for control of major diseases of field and horticultural crops grown in the Kharif season.
COb5	Check and validate the various management practices for major diseases of field and horticultural crops grown in the Kharif season.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Define and recall important terms, concepts, and basic principles related to diseases of field and horticultural crops.	L1
CO2	Classify different categories of plant diseases and explain their causes, modes of spread, and general characteristics in field, pulse, cereal, and horticultural crops.	L2
CO3	Identify symptoms, etiology, and disease cycles of major diseases affecting cereals, pulses, and horticultural crops for accurate diagnosis under field conditions.	L3
CO4	Analyze and compare various disease management and control practices, including cultural, biological, chemical, and integrated approaches for different crop groups.	L4
CO5	Evaluate the effectiveness of disease control measures and design suitable Integrated Disease Management (IDM) modules for major field and horticultural crops.	L5 & L6

Syllabus:

Unit-1		Contact Hours: 04
Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira, and tungro. Maize: stalk rots, downy mildew, leaf spots. Sorghum: smuts, grain mold, and anthracnose, Bajra: downy mildew, and ergot.		
Unit-2		Contact Hours: 06
Field Crops: Groundnut: early and late leaf spots, wilt. Soybean: Rhizoctonia blight, bacterial spot, seed, and seedling rot and mosaic. Pigeonpea: Phytophthora blight, wilt, and sterility mosaic. Black & green gram: Cercospora leaf spot and anthracnose, web blight, and yellow mosaic.		
Unit-3		Contact Hours: 05
Field Crops: Finger millet: Blast and leaf spot. Castor: Phytophthora blight. Tobacco: black shank, black root rot, and mosaic.		
Unit-4		Contact Hours: 06
Horticultural Crops: Guava: wilt and anthracnose. Bananas: Panama wilt, bacterial wilt, Sigatoka, and bunchy top. Papaya: foot rot, leaf curl, and mosaic, Pomegranate: bacterial blight. Plantation Crops: Coconut: wilt and bud rot. Tea: blister blight, Coffee: rust		
Unit-5		Contact Hours: 07
Vegetable Crops: Horticultural Crops: Cruciferous vegetables: Alternaria leaf spot and black rot. Brinjal: Phomopsis blight or fruit rot and Sclerotinia blight. Tomato: damping off, wilt, early and late blight, buck eye rot, and leaf curl and mosaic. Okra: Yellow Vein Mosaic. Beans: anthracnose and bacterial blight. Ginger: soft rot. Colocasia: Phytophthora blight.		
Practical	Suggested list of Exercises	
1	To get acquainted with various phytopathological instruments present in the laboratory	
2	To study the various parts of the microscope and its uses	
3	To study the isolation process of diseased samples from leaf	
4	Diagnosis of plant-diseased samples of field crops	
5	Collection of plant-diseased samples of field crops	
6	Identification of plant-diseased samples of field crops	
7	Preservation of plant-diseased samples of field crops	
8	Diagnosis of plant-diseased samples of field crops	
8	Collection of plant-diseased samples of horticultural crops	

10	Identification of plant-diseased samples of horticultural crops
11	Preservation of plant-diseased samples of horticultural crops
12	To know various methods of identification of plant diseases caused by the pathogen

Suggestive Readings:

Text Books:

T1. Singh, R.S. (2005). Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

References:

R1. H. C. Dube (2014) Modern plant pathology Agrobios (India).

R2. Chincholkar, K.D (2008). Plant diseases. Rajat Publications., New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	20			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
Practical Exam	<input checked="" type="checkbox"/>	1hr	20			Levels 3 to 6
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	1	0	1	1	0	1	0
CO2	2	3	1	0	2	2	1	1	0
CO3	3	3	1	1	3	3	1	0	1
CO4	3	3	2	2	3	3	2	0	2
CO5	3	3	3	3	3	3	2	1	3

Course: Rainfed Agriculture & Watershed Management

Program	B.Sc. (Hons.) Agriculture	Semester				VI
Course Name	Rainfed Agriculture & Watershed Management	L	T	P	C	Course Type
Course Code	AGR C305	1	0	0	1	Core

Course Objective:

This course ensures that the students understand how:

COb1	To provide students with a comprehensive understanding of the concept, history, types, problems, and prospects of rainfed agriculture in India , including the soil and climatic conditions prevalent in rainfed regions.
COb2	To impart knowledge and skills related to soil and water conservation techniques for sustainable use of natural resources in rainfed farming systems.
COb3	To develop the ability to understand types of drought, physio-morphological effects of water deficit on crops, and crop adaptation and mitigation strategies under drought-prone conditions.
COb4	To educate students on the importance and techniques of water harvesting, efficient utilization of water through soil and crop management practices, and management of crops in rainfed areas.
COb5	To empower students with competencies in contingent crop planning for aberrant weather conditions and the concepts, principles, components, and factors affecting watershed management for designing sustainable agricultural solutions and independent projects.

Course Outcomes:

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the concept, types, historical development, problems, and prospects of rainfed agriculture in India, including the soil and climatic characteristics of rainfed regions.	L1 & L2	Mid Term
CO2	Apply appropriate soil and water conservation techniques to minimize land degradation and improve productivity in rainfed farming systems.	L3	Mid Term
CO3	Analyze the types of drought, their effects on physio-morphological characteristics of crops, and evaluate crop adaptation and drought mitigation strategies.	L4	Case Studies/ Project/ Assignment
CO4	Demonstrate the ability to plan and implement water harvesting techniques, efficient water utilization practices, and crop management	L5	End Term Examination

	strategies for rainfed areas.		
CO5	Design contingent crop plans for aberrant weather conditions and formulate watershed management strategies using principles, components, and influencing factors to ensure sustainable rainfed agriculture.	L5	End Term Examination

Syllabus:

Unit I	Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India; Soil and climatic conditions prevalent in rainfed areas.
Unit II	Soil and water conservation techniques
Unit III	Drought: types, effect of water deficit on physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought.
Unit IV	Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas.
Unit V	Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Suggestive Readings:

Text Books:

T1. SR Reddy and G Prabhakara Reddy, 2018. Rainfed Agriculture and Watershed Management. Kalyani Publications, New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	40			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	0	1	2	1	2	0
CO2	2	3	2	1	3	3	1	1	1
CO3	2	3	2	1	2	3	1	1	1
CO4	2	3	2	1	3	3	1	1	1
CO5	2	2	2	2	2	3	2	2	3

Course: Diseases of Field and Horticultural Crops and their Management-II

Program	B.Sc. (Hons.) Agriculture	Semester				VI
Course Name	Diseases of Field and Horticultural Crops and their Management-II	L	T	P	C	Course Type
Course Code	AGR C306	2	0	1	3	CORE

Course Objectives:

- a) Understand the symptoms, causal organisms, and disease cycles of major diseases of field and horticultural crops.
- b) Explain the epidemiology and factors influencing disease development in different agro-climatic conditions.
- c) Apply integrated disease management practices including cultural, biological, chemical, and host resistance methods.
- d) Analyze disease problems in economically important crops and recommend appropriate management strategies.
- e) Evaluate the impact of plant diseases on crop productivity and sustainability.

2. Course Outcomes:

At the end of the course the students will be able to-

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
1.	Describe symptoms, etiology, and disease cycles of major field and horticultural crop diseases.	2	Mid Term
2.	Explain epidemiological factors affecting disease development in different crops.	2	Mid Term
3.	Apply integrated disease management strategies for effective control of crop diseases.	3	End term, case study
4.	Interpret disease situations in field and horticultural crops and suggest appropriate management practices.	4	End term
5.	Evaluate the economic importance and management efficiency of disease control measures in crop production.	5	End term, case study

Syllabus:

Unit No	Content
UNIT I	Symptoms, etiology, disease cycle and management of following diseases: Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng.
UNIT II	Field Crops: Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust
UNIT III	Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl.
UNIT IV	Horticultural Crops: Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl.
UNIT V	Horticultural Crops: Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.
Practical	Suggested list of Exercises
1	To get acquaintance with various phyto-pathological instruments present in the laboratory
2	To study the different parts of microscope and its uses
3	To study isolation process of diseased samples from leaf
4	Diagnosis of plant diseased samples of field crops

Suggestive Readings:**Text Books:**

1. Singh, R.S. 2005. Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Pathak, V. N. 1980. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Singh, R.S. 1994. Diseases of Vegetable Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Singh, R.S. 2000. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

5. Varma, L.R. and Sharma, R.C. 1999. Diseases of Horticultural Crops. Indus Publishing Co., New Delhi.

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2hr	40			Levels 1 to 2
Assignment/ Case Studies/ Project	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprise Quiz	<input checked="" type="checkbox"/>	10mins	05			Level 1
End term Examination	<input checked="" type="checkbox"/>	3hr	50			Levels 3 to 5

Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	B	c	d	e	f	g	h	I
Course Outcomes									
1	2	1	1	2	2	1	0	2	3
2	1	3	3	1	0	1	2	2	2
3	2	2	3	2	3	3	2	1	3
4	1	2	3	1	2	2	3	1	2
5	3	2	1	3	3	3	1	2	3

Course: Fundamentals of Plant Biochemistry and Biotechnology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Plant Biochemistry and Biotechnology	L	T	P	C	Course Type
Course Code	AGR E001	2	0	1	3	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To provide fundamental knowledge of biomolecules, enzymes, nucleic acids, and metabolic pathways essential for plant and agricultural sciences.
COb2	To understand the structural organization and functional significance of carbohydrates, lipids, proteins, and nucleic acids in living systems.
COb3	To explain enzyme kinetics and metabolic processes involved in carbohydrate and lipid metabolism.
COb4	To introduce principles, techniques, and applications of plant biotechnology in crop improvement.
COb5	To familiarize students with recombinant DNA technology, molecular markers, and regulatory aspects of agricultural biotechnology.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the importance, classification, structure, and properties of biomolecules including carbohydrates, lipids, proteins, nucleic acids, water, buffers, and enzymes.	L2	Mid Term
CO2	Describe enzyme classification, mechanisms of action, enzyme kinetics (Michaelis–Menten and Lineweaver–Burk), and regulatory enzymes involved in metabolic pathways.	L2	Mid Term
CO3	Analyze major metabolic pathways of carbohydrates and lipids, including glycolysis, TCA cycle, glyoxylate cycle, electron transport chain, β -oxidation, and fatty acid biosynthesis.	L4	Case Studies/ Project/ Assignment
CO4	Apply concepts and techniques of plant tissue culture, micropropagation, somatic hybridization, synthetic seeds, cryopreservation, and somaclonal variation for crop improvement.	L3	Practical Examination
CO5	Evaluate recombinant DNA technologies, gene transfer methods, molecular markers, marker-assisted breeding, transgenic crops, and	L5	End Term Examination

	biotechnology regulations in agriculture.		
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• **Syllabus:**

Unit-1		Contact Hours: 2
Importance of Biochemistry. Properties of Water, pH and Buffer.		
Unit-2		Contact Hours: 3
Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots.		
Unit-3		Contact Hours: 3
Introduction to allosteric enzymes. 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) and metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids		
Unit-4		Contact Hours: 3
Concepts, applications and scope of plant biotechnology: organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation.		
Unit-5		Contact Hours: 3
Introduction to recombinant 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		
Practical	Suggested list of Exercises	
1	Identification and SOP of major and minor instruments used in Biochemistry	
2	Exercise on Normality and Molarity	
3	Preparation of Solutions	
4	General Test for Carbohydrates	
5	Exercise on confirmatory test for reducing and Non reducing sugars	

6	Exercise on test for polysaccharides
7	Exercise on test for proteins and amino acids
8	Exercise on test for lipids
9	Exercise of Colorimetry
10	Exercise on Spectrophotometry
11	Exercise on Chromatography
12	Exercise on Electrophoresis

- **Books:**

Textbooks: -

T1. BD Singh, Payal Bansal. Plant Biotechnology, Kalyani Publishers. New Delhi

T2. J.L. Jain. Fundamentals of Biochemistry. S. Chand New Delhi

Reference Books: -

R1. BD Singh. Biotechnology-Expanded Horizons, Kalyani Publishers New Delhi.

- **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	0	0	0	0	0	0	1
CO2	3	2	2	0	0	3	0	0	0
CO3	2	2	3	0	2	3	1	1	0
CO4	2	3	2	3	0	1	2	0	0
CO5	0	2	3	2	2	3	2	1	2

Course: Agricultural Microbiology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Agricultural Microbiology	L	T	P	C	Course Type
Course Code	AGR E002	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the history, scope, and significance of microbiology and the structural and genetic diversity of microorganisms relevant to agriculture.
COb2	To explain the role of microorganisms in soil fertility, nutrient cycling, and plant–microbe interactions for sustainable crop production.
COb3	To impart knowledge on applied microbiology including biodegradation of agrochemicals, food and dairy microbiology, rural microbiology, and silage production.
COb4	To familiarize students with the role of microorganisms in human welfare, industrial production, and plant and human diseases.
COb5	To develop understanding of eco-friendly microbial technologies such as biofertilizers, biopesticides, composting, and waste recycling in agriculture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the history of microbiology and describe the structure, genetics, distribution, and agricultural importance of prokaryotic and eukaryotic microorganisms.	L2	Mid Term
CO2	Explain the role of microorganisms in soil fertility and crop production, including nutrient cycles (C, N, P, S) and plant–microbe associations such as nitrogen fixation, Azolla, and mycorrhiza.	L2	Mid Term
CO3	Apply microbiological principles in biodegradation of agricultural chemicals and organic wastes, dairy microbiology, rural microbiology, and silage production.	L3	Case Studies/ Project/ Assignment
CO4	Analyze the role of microorganisms in human welfare, industrial production, and differentiate between beneficial and pathogenic microbes affecting humans and plants.	L4	Practical Examination

CO5	Evaluate and apply microbial technologies such as biofertilizers, biopesticides, composting, waste treatment, and recycling for sustainable agriculture.	L5	End Term Examination
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• **Syllabus:**

Unit-1		Contact Hours: 2
Microbial world history- History of microbiology prokaryotic and eukaryotic microbes, their cell structure, genetics distribution in nature and importance in agriculture.		
Unit-2		Contact Hours: 3
Microorganisms in soil fertility and crop production; carbon, nitrogen, phosphorus and sulphur cycles, plant microbes association symbiotic associative and asymbiotic nitrogen fixation, Azolla and mycorrhiza		
Unit-3		Contact Hours: 3
Biodegradation of agricultural chemicals pesticides, herbicides and agricultural organic wastes; Microbiology of milk and milk products, rural microbiology and silage production.		
Unit-4		Contact Hours: 3
Microbes in human welfare, ethanol production, antibiotic production, Human and plant pathogenic microbes.		
Unit-5		Contact Hours: 3
Biofertilizers, bipesticides, waste treatment and recycling; composting.		
Practical	Suggested list of Exercises	
1	To know the rules applied in Microbiology Laboratory	
2	To study the different glassware's and equipment's used in Microbiology Laboratory	
3	To Prepare Nutrient Agar Media (NAM)	
4	To study the different methods of Sterilization	
5	To study the different plating techniques in microbiology	
6	To differentiate the two types of bacteria by grams staining	
7	To test the quality of milk by MBRT (Methylene Blue Reductase Test) test	
8	To learn the Microbial Analysis of Food Items	
9	To conduct Alkaline Phosphatase test for Pasteurized milk	
10	To study the Microbial analysis of air	
11	To study the Microbial analysis of water	
12	To study the Microbial analysis of soil	

- **Books:**

Textbooks: -

T1. R.K.Singh A text book of Microbiology, Kalyani Publishers New Delhi

Reference Books: -

R1. Adesh Kumar Agricultural Microbiology, Kalyani Publishers. New Delhi

- **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

- **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	0	0	0	1
CO2	3	2	2	0	0	3	0	0	0
CO3	2	2	3	0	2	3	1	1	0
CO4	2	3	2	3	0	1	2	0	0
CO5	0	2	3	2	2	3	2	1	2

Course: Fundamentals of Crop Physiology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Crop Physiology	L	T	P	C	Course Type
Course Code	AGR E003	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the basic concepts of plant physiology, plant cell structure, thermodynamics, diffusion, and osmosis.
COb2	To develop understanding of water relations in plants, including water potential, absorption, transpiration, stomatal behavior, and ascent of sap.
COb3	To explain mechanisms of mineral nutrition, ion uptake, metabolic utilization, and deficiency symptoms in plants.
COb4	To impart knowledge on major physiological processes such as photosynthesis, respiration, fat metabolism, growth, development, and plant growth regulators.
COb5	To relate physiological processes with productivity and yield of major cereal, pulse, and oilseed crops.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain basic principles of plant physiology, plant cell organization, thermodynamics, diffusion, and osmosis.	L2	Mid Term
CO2	Describe plant water relations including water potential, absorption, transpiration, stomatal physiology, and ascent of sap.	L2	Mid Term
CO3	Analyze mechanisms of mineral ion uptake, their metabolic utilization, and deficiency symptoms in plants.	L4	Case Studies/ Project/ Assignment
CO4	Explain photosynthesis, respiration, fat metabolism, and physiological aspects of plant growth, development, and growth regulators.	L2	Practical Examination
CO5	Evaluate physiological parameters influencing productivity of major cereal, pulse, and oilseed crops.	L5	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
An introduction to plant physiology, plant cell, laws of thermodynamics, diffusion and osmosis.		
Unit-2		Contact Hours: 3
Concept of water potential, cell water relations, absorption of water, transpiration, stomatal physiology, ascent of sap.		
Unit-3		Contact Hours: 3
Ion uptake and metabolic utilization of mineral ions, deficiencies of mineral ions in plants.		
Unit-4		Contact Hours: 3
Photosynthesis, respiration, fat metabolism, physiology of growth and development, growth regulators.		
Unit-5		Contact Hours: 3
Physiological parameters influencing the productivity of major cereal, pulse and oilseed crops.		
Practical	Suggested list of Exercises	
1	Structure of a Plant and Animal Cell	
2	Preparation of Solutions	
3	Exercise on Diffusion	
4	Exercise on Osmosis using potato	
5	Field experiment on Guttation	
6	Exercise on Transpiration in plants	
7	Study of the structure of stomata	
8	Chromatographic method of separation of plant pigments	
9	Exercise on Imbibitional Pressure	
10	Inverted Cone Experiment	
11	Exercise on measurement of LAI	
12	Exercise on Nutrient deficiencies in Plants	

• **Books:**

Textbooks: -

T1. S.N. Pandey & B.K. Sinha, Plant Physiology

T2. P.S. Gill, Plant Physiology

Reference Books: -

R1. V. K. Jain, Fundamentals of Plant Physiology

- Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

- Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	0	0	0	1
CO2	3	2	0	1	0	1	0	0	0
CO3	2	3	1	2	0	1	0	0	0
CO4	3	2	1	0	0	1	0	0	0
CO5	2	3	3	1	0	2	0	1	2

Course: Food Safety and Standards

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Food Safety and Standards	L	T	P	C	Course Type
Course Code	AGR E004	1	0	0	1	DSE

1. Course Objectives:

This course ensures that the students understand how:

COb1	To know about the concept, need, importance, scope of food safety.
COb2	To develop skills toward identifying factors affecting food safety and describe various types of food hazards and ways to tackle it.
COb3	To study about hygiene, sanitation, waste disposal, the significance of quality, TQM, Food Regulatory Laws of Uttarakhand, India and International.
COb4	To develop entrepreneurial skills through the knowledge of packaging, product & nutritional labeling and discovering the organizations associated with quality management.
COb5	To develop a competitive teaching-learning environment for enabling students for higher studies in the field of food handling, management and newer approaches to food safety and standards.

Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Course Outcomes	Bloom's Taxonomy level
CO1	Identify the scope, need, and importance of food safety along with basic food safety standards and regulations for food commodities.	L1
CO2	Explain principles of food microbiology including identification of bacteria through biochemical tests and understanding microbial contamination in foods.	L2
CO3	Apply quality management concepts such as food standards, Total Quality Management (TQM), personal hygiene, and sanitation practices in food safety operations.	L3
CO4	Analyze factors affecting food safety including microbial hazards, quality hazards, risks, and examination of different food samples for contamination.	L4
CO5	Evaluate food products for safety compliance through inspection of labeling, nutritional labeling, packaging, and overall quality assurance measures.	L5

Syllabus:

Unit-1		Contact Hours: 4
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.		
Unit-2		Contact Hours: 6
Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene.		
Unit-3		Contact Hours: 6
Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM.		
Unit-4		Contact Hours: 6
Concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food.		
Unit-5		Contact Hours: 6
Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.		

Suggestive Readings:**Text Books:**

T1. Abdul Kareem, Food Safety and Standards, Kalyani Publications

Reference Books:-

R1. Alok Kumar, Fundamentals of Food Hygiene, Safety and Quality, Rekha printers, published by Willey

R2. Ram Asrey and Kalyan Barman, Post Harvest Horticulture, Principles and Practices, Kalyani Publishers

Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 4

Course: Renewable Energy and Green Technology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Renewable Energy and Green Technology	L	T	P	C	Course Type
Course Code	AGR E005	1	0	1	2	DSE

1. Course Objectives:

This course ensures that the students understand how:

COb1	Understand the classification of energy sources and their contribution to the agricultural sector.
COb2	Explain the process of biomass utilization for biofuel production to propose sustainable energy solutions for agricultural operations and its applications in agriculture.
COb3	Analyze the effectiveness of solar energy gadgets and systems in various agricultural applications.
COb4	Develop innovative projects incorporating non-conventional energy sources like wind energy for enhancing agricultural productivity.
COb5	Evaluate the potential of modern technology to solve problems in the farming community and foster personal and entrepreneurial growth.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the classification of conventional and non-conventional energy sources and describe their contributions to the agricultural sector.	L1
CO2	Explain the principles of biomass utilization, biofuel production, and the importance of bioenergy resources for sustainable agricultural development.	L2
CO3	Apply knowledge of biogas plants, gasifiers, and solar energy technologies (solar cookers, solar heaters, solar dryers, photovoltaic systems) to improve farm operations and energy efficiency.	L3
CO4	Analyze energy utilization problems in agriculture and evaluate appropriate renewable energy technologies and agro-based industries for effective and sustainable solutions.	L4
CO5	Design and develop integrated renewable energy projects and entrepreneurial models using biomass, biogas, solar, and wind energy for sustainable agricultural production and innovation.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 2
Classification of energy sources, contribution of these of sources in agricultural sector.		
Unit-2		Contact Hours: 3
Familiarization with biomass utilization for biofuel production and their application.		
Unit-3		Contact Hours: 3
Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, biodiesel and bio-oil production and their utilization as bioenergy resource.		
Unit-4		Contact Hours: 3
Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application.		
Unit-5		Contact Hours: 3
Other Non-conventional sources of energy. Introduction of wind energy and their application.		
Practical	Suggested list of Exercises	
1	To study the solar pumping system.	
2	To study the solar fencing system.	
3	To study of Production Process of Briquettes.	
4	To study the function of solar cooker.	
5	To study solar distillation and solar pond.	
6	To study the production process of bio-fuels.	
7	Familiarization with different solar energy gadgets.	
8	To study about the Hydro-energy.	
9	To study about the Wind energy.	
10	Visit to a near by solar farm.	
11	To study the concept of eco-friendly gadgets.	
12	To study the working and usefulness of Biogas.	

4. Suggestive Readings:

Text Books:

T1. D. Mukherjee, S Chakrabarti, “Fundamental of Renewable Energy Systems”, First Edition, New Age International (P) Ltd., Publishers, 2004.

Reference book:

R1. D P Kothari, K C Singhal, Rakesh Ranjan. Renewable Energy, Sources and Emerging Technologies, Ninth Print (Second Edition), PHI Learning Private Limited, 2016.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	0	0	1	1	0	1	0
CO2	1	3	1	1	1	2	1	1	0
CO3	1	2	1	2	3	2	2	1	2
CO4	0	2	2	2	2	3	3	1	2
CO5	0	2	2	3	2	3	3	2	3

Course: Application of Drones in Agriculture

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Application of Drones in Agriculture	L	T	P	C	Course Type
Course Code	AGR E026	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COB1	To introduce students to the basic concepts and components of drone technology used in agriculture.
COB2	To familiarize learners with different types of agricultural drones and onboard sensors.
COB3	To impart fundamental knowledge of drone operations, flight planning, and data acquisition.
COB4	To explain major applications of drones in crop monitoring, irrigation, and pest management.
COB5	To create awareness about safety guidelines, regulations, and future scope of drones in Indian agriculture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the principles, types, and components of drones used in agriculture.	L2	Mid Term
CO2	Identify appropriate sensors and imaging methods for agricultural data collection.	L2	Mid Term
CO3	Demonstrate basic understanding of drone operation, flight planning, and pre-flight procedures.	L3	Case Studies/ Project/ Assignment
CO4	Apply drone-based information for crop health assessment, irrigation management, and pest surveillance.	L3	Practical Examination
CO5	Recognize regulatory requirements, safety practices, and emerging opportunities of drone technology in agriculture.	L2	End Term Examination

- **Syllabus:**

Unit-1		Contact Hours: 2
Definition and evolution of drones		
Classification of drones used in agriculture		

Major components of agricultural drones		
Advantages of drone use in farming		
Unit-2		Contact Hours: 3
Types of sensors: RGB, multispectral and thermal (introductory)		
Principles of aerial imaging		
Resolution, altitude and coverage basics		
Data acquisition for agricultural applications		
Unit-3		Contact Hours: 3
Basics of drone operation		
Pre-flight checks and calibration		
Flight planning concepts		
Factors affecting drone performance in agricultural fields		
Unit-4		Contact Hours: 3
Crop health monitoring		
Pest and disease detection		
Irrigation and water stress assessment		
Crop growth assessment and yield estimation		
Concept of drone-based spraying		
Unit-5		Contact Hours: 3
Overview of DGCA guidelines for agricultural drones		
Safety measures and ethical considerations		
Limitations and challenges in adoption		
Future scope of drones in Indian agriculture		
Practical	Suggested list of Exercises	
1	Identification of drone components and accessories	
2	Demonstration of different types of agricultural drones	
3	Drone assembly and pre-flight inspection (demonstration)	
4	Demonstration of flight planning and mission software	
5	Demonstration of basic drone flying (take-off, hovering, landing)	

6	Demonstration of aerial image and video capture over fields
7	Basic interpretation of crop images for stress identification
8	Demonstration of major agricultural applications (mapping, monitoring, spraying)

• **Books:**

Textbooks: -

T4. ICAR. Precision Agriculture and Smart Farming publications

Reference Books: -

R1. Extension manuals on drone applications in agriculture

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
O1	3	0	0	0	3	0	0	0	1
CO2	2	2	0	2	3	0	0	0	0
CO3	2	1	0	0	3	0	2	0	0
CO4	2	3	3	2	3	2	0	1	0
CO5	1	0	0	0	2	1	3	0	2

Course: Problematic Soils and their Management

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Problematic Soils and their Management	L	T	P	C	Course Type
Course Code	AGR E007	2	0	0	2	DSE

1. Course Objectives:

This course ensures that the students understand how:

COb1	Provide comprehensive education and research opportunities focused on the identification
COb2	Equip students with the expertise to diagnose specific issues related to problematic soils
COb3	Foster a culture of ethical integrity
COb4	Empower students to conceive
COb5	Develop a competitive teaching-learning environment that prepares students for advanced studies and careers in the specialized field of soil science

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall and define key terms related to problematic soils such as saline, sodic, acidic, compacted, polluted soils, and wastelands.	L1
CO2	Explain the processes of formation, distribution, characteristics, and classification of problematic soils and wastelands in India.	L2
CO3	Apply appropriate management and reclamation practices to improve acid, acid sulfate, saline, sodic, and polluted soils under agricultural conditions.	L3
CO4	Analyze the impact of irrigation water quality and soil pollution on soil health and evaluate the effectiveness of different soil reclamation and management techniques.	L4
CO5	Design comprehensive soil management and reclamation plans for specific problematic soils based on regional conditions and crop requirements.	L5

3. Syllabus:

Unit-1		Contact Hours: 5
Soil quality and health, distribution of Waste land and problem soils in India. Their categorization based on properties.		
Unit-2		Contact Hours: 8
Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils.		
Unit-3		Contact Hours: 5
Reclamation and management of Eroded and Compacted soils, Flooded soils, Polluted soils, Hill soil of Uttarakhand.		
Unit-4		Contact Hours: 5
Irrigation water – quality and standards, utilization of saline water in agriculture.		

4. Suggestive Readings:

Text Books:

T1. Dilip Kumar Das 2011. Introductory Soil Science. 3rd revised edition. Kalyani Publishers, New Delhi.

References:

R1. S.K. Datta, 1999. Soil Conservation and Land Management. International Book Distributors, Dehradun.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	0	0	1	1	0	1	0
CO2	2	3	0	0	2	2	0	1	0
CO3	2	2	1	1	3	3	1	0	1
CO4	1	2	1	1	2	3	1	1	2
CO5	1	2	2	3	3	3	2	1	3

Course: Agri- Informatics

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Agri- Informatics	L	T	P	C	Course Type
Course Code	AGR E008	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce fundamentals of computers, operating systems, databases, and programming concepts relevant to agriculture.
COb2	To develop skills in using MS-Office tools for documentation, data analysis, graphical presentation, and statistical interpretation.
COb3	To impart knowledge on ICT, e-Agriculture, and IT-enabled tools for crop, water, nutrient, and input management.
COb4	To familiarize students with geospatial technologies, decision support systems, expert systems, and soil information systems for farm decision-making.
COb5	To enable students to apply IT tools for contingent crop planning and smart agricultural management in Indian and Uttarakhand contexts.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the fundamentals of computers, operating systems, databases, programming concepts, and World Wide Web components.	L2	Mid Term
CO2	Demonstrate the use of MS-Office tools for document preparation, data presentation, statistical analysis, graph creation, and mathematical computations.	L3	Mid Term
CO3	Explain the concepts and applications of e-Agriculture, ICT tools, mobile apps, and computer-controlled systems for agricultural input and farm management.	L2	Case Studies/ Project/ Assignment
CO4	Analyze the role of geospatial technologies, decision support systems, expert systems, and soil information systems in supporting farm decisions.	L4	Practical Examination
CO5	Design contingent crop-planning strategies using IT tools and computer	L6	End Term

	models for sustainable agricultural decision-making.		Examination
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• **Syllabus:**

Unit-1		Contact Hours: 2
Introduction to Computers, Operating Systems, definition and types, Applications of MS- Office for document creation & Editing; Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions. Database, concepts and types, uses of DBMS in Agriculture,		
Unit-2		Contact Hours: 3
World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.		
Unit-3		Contact Hours: 3
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 advises market price, postharvest management etc. and its importance in Uttarakhand and Indian context.		
Unit-4		Contact Hours: 3
Geo-spatial 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.		
Unit-5		Contact Hours: 3
Preparation of contingent crop-planning using IT tools.		
Practical	Suggested list of Exercises	
1	Assembling of computer systems and peripherals.	
2	Loading/ Replacing Operating System	
3	Text handling and formatting in MS Word	
4	Data handling, analysis and interpretation using MS Excel.	
5	Database handling on any DBMS Software	
6	Exercise on concept of www, E-mail.	
7	Exercise on Agri-informative websites : E-mandi	
8	Exercise on Agri-informative websites : E-NAM	
9	Exercise on area calculation using GPS	
10	Study of common Agri-Apps and usage.	

11	Data interpretation from GPS enabled images – Soil Resources
12	Data interpretation from GPS enabled images – water Resources

- **Books:**

Textbooks: -

T1. Narayan Jitendra. Agri-Informatics. Kalyani Publishers.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

- **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	2	0	0	0	1
CO2	2	2	0	3	3	0	0	2	1
CO3	2	2	2	0	3	2	0	2	0
CO4	2	3	3	2	3	2	0	0	0
CO5	2	3	3	2	3	3	0	1	2

Course: Introductory Agro-meteorology & Climate Change

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Introductory Agro-meteorology & Climate Change	L	T	P	C	Course Type
Course Code	AGR E009	1	0	1	2	DSE

• **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the meaning, scope, and importance of agricultural meteorology and the structure and composition of the earth's atmosphere.
COb2	To explain atmospheric weather variables, radiation, temperature, humidity, precipitation, and related physical processes.
COb3	To develop understanding of weather systems, monsoon mechanism, and weather hazards affecting agriculture.
COb4	To explain agriculture–weather relationships, crop microclimate modification, and climatic requirements for crops and livestock.
COb5	To impart knowledge on weather forecasting, climate change, climatic variability, and their impacts on regional (Uttarakhand) and national agriculture.

• **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the meaning, scope of agricultural meteorology, structure of the atmosphere, and basic weather variables including pressure and wind.	L2	Mid Term
CO2	Describe the nature of solar radiation, energy balance of the earth, atmospheric temperature, lapse rate, and temperature inversion.	L2	Mid Term
CO3	Explain atmospheric humidity, condensation processes, cloud formation, precipitation types, and artificial rainmaking techniques.	L2	Case Studies/ Project/ Assignment
CO4	Analyze monsoon mechanisms, weather hazards (drought, floods, frost, cyclones, heat and cold waves), and their effects on agriculture.	L4	Practical Examination
CO5	Evaluate agriculture–weather relationships, weather forecasting systems, climate change impacts, and adaptation strategies for Uttarakhand and Indian agriculture.	L5	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed.		
Unit-2		Contact Hours: 3
Cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo.		
Unit-3		Contact Hours: 3
Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth.		
Unit-4		Contact Hours: 3
Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave.		
Unit-5		Contact Hours: 3
Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional (Bhabar region, Uttarakhand) and national Agriculture.		
Practical	Suggested list of Exercises	
1	Measurement of soil temperature through soil thermometer.	
2	To examine the measurement of rainfall through rain gauge in field.	
3	Measurement of wind direction and speed through anemometer in field.	
4	To study about different instruments used in agrometeorology.	
5	Calculation of local mean time.	
6	Determination of dew point temperature.	
7	To study about the Temperature measurement through Thermometer.	
8	Examine the site selection and experimental Layout of agro meteorological observatory.	
9	Benefits of weather services to agriculture.	
10	To study the Measurement of total, short wave and long wave radiation.	

11	To learn about the how to measure Air Pressure through Barometer.
12	Visit of nearby Agro-meteorological Observatory

- **Books:**

Textbooks: -

T1. Mavi H. S. *Introduction to Agrometeorology* 2Ed Oxford & IBH Publishing Co Pvt.Ltd

Reference Books: -

R1. A.K. Srivastava. *Practical Agricultural Meteorology* New India Publishing Agency

- **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

- **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	1	0	0	1
CO2	3	1	0	0	0	2	0	0	0
CO3	2	1	0	0	0	2	0	0	0
CO4	2	3	2	0	0	3	0	0	0
CO5	2	3	3	1	0	3	0	1	2

Course: Geoinformatics and Nano-technology and Precision Farming

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Geoinformatics and Nano-technology and Precision Farming	L	T	P	C	Course Type
Course Code	AGR E010	2	0	0	2	DSE

1. Course Objectives:

This course ensures that the students understand how:

COb1	Understand concept and principle of precision agriculture with respect to Indian Agriculture
COb2	Understand the uses of geoinformatics in Precision farming
COb3	Identify the yield monitoring and crop discrimination and to recommend fertilizer through geospatial technology
COb4	Encourage the students to develop crop simulation model through the use of GPS, GIS and Remote sensing tools
COb5	Understand and then applied the principles of nanotechnology in various disciplines of agriculture

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the different tools and components of geo-informatics including GPS, GIS, and remote sensing, and their significance in agriculture.	L1
CO2	Understand the concepts, principles, and techniques of precision farming and nanotechnology and their roles in modern agricultural production systems.	L2
CO3	Apply geo-informatics tools and precision farming techniques for fertilizer recommendations, crop monitoring, and preparation of crop simulation models.	L3
CO4	Analyze field crop and soil problems using remote sensing, GIS data, and nanotechnology-based approaches to identify appropriate solutions.	L4
CO5	Design precision agriculture strategies and decision-support systems by integrating geo-informatics, simulation modeling, and nanotechnology for improving productivity and sustainability.	L5

3. Syllabus:

Unit-1		Contact Hours: 04
Precision agriculture: concepts and techniques; their issues and concerns for Uttarakhand and Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture.		
Unit-2		Contact Hours: 04
Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies.		
Unit-3		Contact Hours: 05
Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions.		
Unit-4		Contact Hours: 05
Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.		
Unit-5		Contact Hours: 06
Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.		

4. Suggestive Readings:

Text Books:

T1: Fundamentals of Agronomy by Gopal Chandra De, Oxford & IBH Publishing, 2013.

T2: Introductory Soil Science by Dilip Kumar Das, Kalyani Publications, 2015.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	0	0	1	1	1	1	0
CO2	1	3	1	0	2	2	1	1	0
CO3	2	2	1	2	3	3	2	1	2
CO4	2	2	1	1	3	3	1	1	2
CO5	2	2	2	3	3	3	2	1	3

Course: Intellectual Property Rights

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Intellectual Property Rights	L	T	P	C	Course Type
Course Code	AGR E011	1	0	0	1	DSE

1. Course Objectives:

This course ensures that the students understand how:

COb1	Provide students with a comprehensive understanding of intellectual property concepts
COb2	Enable students to analyze and interpret various international treaties and domestic legislations governing intellectual property rights
COb3	Familiarize students with the traditional procedures involved in patent filing and licensing
COb4	Empower students with the requisite competencies to navigate the regulations of UPOV (Union for the Protection of New Varieties of Plants) and PPV&FR (Protection of Plant Varieties and Farmers' Rights)
COb5	Cultivate an intellectually stimulating learning environment conducive to fostering advanced competencies in the domain of intellectual property rights

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall the fundamental concepts, importance, and types of Intellectual Property Rights (IPR) and major international agreements and legislative frameworks governing IPRs in India.	L1
CO2	Explain the principles, scope, and legal provisions related to patents, copyrights, trademarks, industrial designs, geographical indications, integrated circuits, and trade secrets, including the Patents Act, 1970.	L2
CO3	Apply knowledge of patent filing procedures, patentability criteria, specifications, claims, and the registration process of plant varieties under the PPV&FR Act, 2001, including the rights of breeders, researchers, and farmers.	L3
CO4	Analyze the concepts of traditional knowledge, biodiversity protection, and evaluate the effectiveness of compliance and enforcement mechanisms of international treaties such as CBD,	L4

	ITPGRFA, and UPOV.	
CO5	Design awareness programs, educational materials, or outreach strategies to promote intellectual property protection, plant variety rights, biodiversity conservation, and equitable benefit sharing among stakeholders.	L5

3. Syllabus:

Unit-1		Contact Hours: 2
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. Types of Intellectual Property and legislations covering IPR in India.		
Unit-2		Contact Hours: 3
Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. 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.		
Unit-3		Contact Hours: 3
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.		
Unit-4		Contact Hours: 3
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.		
Unit-5		Contact Hours: 3
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.		

4. Suggestive Readings:

Text Books:

T1: Intellectual Property Rights by Rajendra Kumar Yadav and Shweta, Kalyani Publications, Ludhiana.

Reference book:

R1: Intellectual Property Rights by JP Mishra, Allahabad Central Law Agency.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	0	2	2	1	0	1	1	1	0
CO2	0	3	2	1	0	1	2	1	0
CO3	1	2	2	2	1	2	2	1	2
CO4	1	2	3	1	1	3	1	2	2
CO5	1	2	3	3	2	2	2	1	3

Course: Micropropagation

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Micropropagation	L	T	P	C	Course Type
Course Code	AGR E012	2	0	1	3	DSE

Course Objectives:

- A. To introduce students to the principles of biotechnology and genetic engineering.
- B. To understand the skill in tissue culture techniques for improvement in the field of agriculture and horticulture crops.
- C. To identify the concepts of breeding for clonal propagation of vegetatively propagated crops.
- D. To learn and apply the in vitro techniques in plant development.
- E. To promote the use of tissue culture techniques for development of disease free plants.

Course Outcomes:

At the end of the course the students will be able to-

S.No.	Course Outcomes	Bloom's Taxonomy level
1.	Identify different types of explants, culture media components, and basic concepts of plant tissue culture techniques used in laboratory experiments.	1
2.	Explain the principles, classification, and importance of various in vitro tissue culture techniques in plant propagation, conservation, and crop improvement.	2
3.	Apply tissue culture methods for micropropagation, disease-free plant production, species conservation, and inter-varietal or wide hybridization not possible through conventional breeding.	3
4.	Analyze and compare different tissue culture techniques and culture media to assess their effectiveness in plant growth, disease elimination, and stress tolerance.	4
5.	Design innovative tissue culture and marker-assisted breeding strategies for developing resistant or stress-tolerant crop varieties and improving crop productivity.	5 & 6

3. Syllabus :

Unit 1:	Introduction, History, Advantages and limitations of Micro propagation.
Unit 2:	Types of cultures (seed, embryo, organ, callus, cell).
Unit 3:	Stages of micro-propagation, axillary bud proliferation (Shoot tip and meristem culture, bud culture).
Unit 4:	Organogenesis (callus and direct organ formation)
Unit 5:	Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Soma-clonal variation, Cryopreservation
Practical	Suggested list of Exercises
1	To learn the rules and regulations in a Laboratory
2	Identification and use of equipment's in a Laboratory
3	To Prepare Nutrient Agar Media (NAM)
4	To study the different methods of Sterilization
5	To know the Preparation of stocks and working solution
6	To know the Preparation of working medium
7	To know the Induction of somatic embryos regeneration of whole plants from different explants
8	Experiments in Callus Induction
9	Experiments in Shoot tip culture

10	Experiments in Embryo / Endosperm Culture
11	To conduct experiment of invitro plants for Hardening and Planting infield
12	Experiments in Isolation of protoplasts

4. Text Books:

T1: Introduction to Plant Biotechnology. Author by H.S. Chawla, Professor-Genetics and Plant Breeding Department, G.B. Pant University of Agriculture & Technology, Pantnagar, India Oxford & IBH Publishing Company Pvt. Ltd. New Delhi ISBN-978-81-204-1732-8 Second edition, last print 2014.

T2: Introduction to Plant Tissue Culture Author by Professor MK Razdan University of Delhi, Oxford & IBH Publishing Company Pvt. Ltd. New Delhi ISBN 978-81-204-1793-9, ISBN: 81-204-1793-3, Third edition reprinted 2022.

References:

T3: Crop Breeding and Biotechnology Author-Hari Har Ram, Former Professor, Plant Breeding and Vegetable Breeding and Head, Vegetable Science, G.B. Pant University of Agriculture and Technology, Pantnagar, Second Revised edition 2019- Kalyani Publishers, New Delhi.

5. Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
Comprehensive Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 4

6. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	1	3	0	0	1	1	0	1	0
2	2	3	1	0	2	2	1	1	0
3	3	2	1	2	3	3	2	1	1
4	2	2	1	1	2	3	1	2	2
5	2	2	2	3	3	3	2	2	3

Course: Principles of Integrated Pest and Disease Management

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Principles of Integrated Pest and Disease Management	L	T	P	C	Course Type
Course Code	AGR E025	1	0	1	2	DSE

7. Course Objective:

This course ensures that the students understand how:

COb1	Make the students learn the important diseases& pests of crops and their management.
COb2	Enable students to identify, detect& diagnose the different diseases & insect-pests of agricultural crops.
COb3	To encourage the ethical marketing skills of different plant protection methods.
COb4	Equip students with latest knowledge in the field of integrated Pest & Disease Management for making successful career in the pesticide industry.
COb5	Counseling students about the importance of competitive exams & higher education in the field of Plant Pathology & Entomology.

8. Course Outcomes:

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Define and explain important terms, concepts, and classifications related to insect pests and plant diseases in crop plants.	1,2	Mid Term
CO2	Classify major categories of insect pests and diseases of crop plants and compare different methods used for their control.	2,3	Mid Term
CO3	Analyze pest population dynamics and determine Economic Injury Level (EIL) and Economic Threshold Level (ETL) for effective pest management.	4	Case Studies/ Project/ Assignment
CO4	Evaluate the environmental, safety, political, social, and legal implications of Integrated Pest Management (IPM) and pesticide use.	5	Practical Examination
CO5	Design and validate appropriate Integrated Pest Management (IPM) modules for insect pest and disease management in crop plants.	6	End Term Examination

9. Syllabus:

Unit No	Content
UNIT I	Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests.
UNIT II	Diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level.
UNIT III	Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control.
UNIT IV	Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases.
UNIT V	Development and validation of IPM module. Implementation and impact of IPM. IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes.
Practical	Suggested list of Exercises
1	To get acquaintance with various entomological instruments present in the laboratory
2	To get acquaintance with various phyto-pathological instruments present in the laboratory
3	To study and collect different predators of insect pests.
4	To study and collect different natural enemies of insect pests
5	To study about the bio-control agents.
6	To know the calculations based on economics of IPM.
7	To know the different methods of plant disease measurement.
8	To know different pesticides and companies manufacturing them.
9	To know different fungicides and companies manufacturing them.
10	To plan awareness campaign for IPM at farmers fields.
11	To study about the IPM module.
12	To know the mass multiplication process of bio-agents.

10. Books:

- **Textbooks**

T1. G.S. Dhaliwal. Elements of Agricultural Entomology, Kalyani Publishers.

T2. T.V. Prasad. Handbook of Entomology. New Vishal Publications.

T3. P.K. Sehgal. Fundamentals of Agricultural Entomology. Kalyani Publishers.

T4. R.S. Singh Plant Pathology. Kalyani Publishers

Reference books:

R1. Robert L. Metcalf and William H. Luckmann. Introduction to Insect Pest Management. Wiley India Pvt. Ltd.

1. Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

2. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	0	0	0	1
CO2	3	3	2	2	1	0	0	0	0
CO3	2	3	2	3	1	0	0	0	0
CO4	0	2	2	0	0	3	3	1	0
CO5	0	2	3	2	2	3	2	2	2

Course: Pests of Crops and Stored Grain and their Management

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Pests of Crops and Stored Grain and their Management	L	T	P	C	Course Type
Course Code	AGR E014	1	0	1	2	DSE

1. Course Objective:

In this course, the students:

1. Recall the identification, taxonomy of various insect pests of crops and stored grains.
2. Understand the host range, biology bionomics, nature of the damage and preventive and curative control measures of crop and stored grain pests.
3. Examine insect infestation, loss assessment, pesticide doses and preparation of solution to spray for pest management.
4. **Design eco-friendly and economically sustainable IPM modules.**
5. Gain in depth knowledge of the pests of crops, stored grains, IPM Modules and management strategies for preparation of competitive exams and higher studies in the field of Agriculture.

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	Bloom's Taxonomy level	Evaluation Method
1.	Identify important insect pests of field and storage crops, their host range, and basic concepts of pest management.	1	Surprise Quiz
2.	Explain the biology, nature of damage, and theoretical principles of pest occurrence along with the social and ethical responsibilities involved in pest control practices.	2	Mid Term
3.	Apply appropriate methods for pest management in field crops and implement scientific storage techniques for safe grain preservation.	3	Assignment/ Project
4.	Analyze pest problems in crops and stored grains by diagnosing causes of infestation and monitoring deterioration due to biotic and abiotic factors.	4	Practical/ Comp. Exam.
5.	Evaluate and select suitable integrated pest management (IPM) strategies and best control measures for effective and sustainable pest control.	5 & 6	Practical/ Comp. Exam.

3. Syllabus:

Unit No	Content
UNIT 1	General account on nature and type of damage by different arthropods pests. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.
UNIT II	Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests of various field crop.

UNIT III	Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests of various fruit and plantation crops.
UNIT IV	Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests of various ornamental crops, spices and condiments.
UNIT V	Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.
Practical	Suggested list of Exercises
1	To get acquaintance with various entomological instruments present in the laboratory.
2	To study various insecticides application techniques.
3	Calculation of insecticidal doses.
4	To study and collect insect pests attacking field Crops.
5	To study and collect insect pests attacking vegetable Crops.
6	To study and collect insect pests attacking fruit Crops.
7	To study and collect insect pests attacking gardens.
8	To study and collect insect pests attacking spices & condiments.
9	To study and collect insect pests attacking plantation crops.
10	To study and collect insect pests of stored grains.
11	To know different insecticides and companies manufacturing them.
12	Determination of insect infestation by different methods.

4. BOOKS:

Text Books: T1. Pests of field crops and Stored Grains and their Management by CH. Raja Goud & K. Manasa.

T2. Agricultural, Pests of South Asia & their Management.

References: R1. Handbook of Entomology by T.V. Prasad.

5. Scheme of Evaluation: (Write evaluation components with weightage):

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5

Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 4

6. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	2	3	1	0	1	1	0	1	0
2	2	3	3	1	2	2	1	1	0
3	3	3	2	2	3	3	2	0	2
4	3	3	2	2	3	3	2	0	2
5	3	3	3	3	3	3	2	1	3

Course: Post-harvest Management and Value Addition of Fruits and Vegetables

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Post-harvest Management and Value Addition of Fruits and Vegetables	L	T	P	C	Course Type
Course Code	AGR E015	1	0	1	2	DSE

1. Course Objective:

The objective of this course is:

- To impart comprehensive knowledge in post-harvest management and value addition of fruits and vegetables, focusing on reducing post-harvest losses and enhancing product quality.
- To equip students with practical skills in handling and processing fruits and vegetables, integrating pre-harvest factors into post-harvest practices for optimal outcomes.
- To instill an understanding of the importance of value addition in agriculture, encouraging innovation and entrepreneurial thinking among students.
- To foster ethical integrity and professional responsibility in post-harvest practices, promoting sustainable agricultural development.
- To prepare students for advanced studies and research in agricultural sciences, providing a strong foundation in post-harvest technologies.

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	Bloom's Taxonomy level	Evaluation Method
1.	Recall and explain the significance of post-harvest processing, causes of post-harvest losses, and the physiological processes of maturity, ripening, and respiration in fruits and vegetables.	1,2	Surprise Quiz
2.	Select and apply appropriate harvesting, field handling, and storage methods (ZECC, cold storage, CA, MA, hypobaric) based on crop requirements to minimize post-harvest losses.	2,3	Mid Term
3.	Implement post-harvest processing techniques such as drying, dehydration, canning, and preparation of intermediate moisture foods for fruits and vegetables.	3	Assignment/ Project
4.	Analyze pre-harvest and post-harvest factors influencing quality and respiration rates of fruits and vegetables and evaluate their management during storage and handling.	4,6	Practical/ Comp. Exam.
5.	Design and produce value-added products such as jams, jellies, and fermented/non-fermented beverages using appropriate post-harvest technologies.	5,6	Practical/ Comp. Exam.

3. Syllabus:

Unit-1		Contact Hours: 02
Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality.		
Unit-2		Contact Hours: 03
Maturity, ripening and changes occur during ripening; Respiration and factors affecting respiration rate.		
Unit-3		Contact Hours: 03

Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).	
Unit-4	Contact Hours: 03
Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages.	
Unit-5	Contact Hours: 03
Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products.	
Practical	Suggested list of Exercises
1	Laboratory instruments in post-harvest technology and their uses.
2	Demonstration of chilling and freezing injury in vegetables and fruits Preparation of jam.
3	Preparation of nectar.
4	Preparation of squash.
5	Preparation of jelly.
6	Preparation of ketchup.
7	Various packaging materials used in post-harvest technology.
8	Effect of packaging material/transport system on the quality of fruits and vegetables.
9	Canning of fruits and vegetables.
10	Dehydration and freezing of fruits and vegetables.
11	Visit to processing unit/industry.
12	Quality evaluation of products -physico-chemical and sensory.

4. BOOKS:

Text Books:

T1. Asrey R and Barman K, “Postharvest Horticulture: Principles and Practices”-, Kalyani Publishers, New Delhi 2021.

T2. Rathore N.S., Mathur G.K. and Chasta S.S., “Post-harvest Management and Processing of Fruits and Vegetables”, I.C.A.R., New Delhi 2012.

Reference Books:-

R1. Handbook of Horticulture (Vol.1), ICAR, New Delhi.

R2. Handbook of Horticulture (Vol.2), ICAR, New Delhi.

5. Scheme of Evaluation: (Write evaluation components with weightage):

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6

End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 4
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6. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	3	2	0	0	0	2	0	0	1
2	2	3	2	0	3	2	1	0	0
3	2	2	3	0	3	2	2	1	0
4	2	3	2	3	1	2	1	0	0
5	0	2	3	2	2	2	1	2	2

Course: Management of Beneficial Insects

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Management of Beneficial Insects	L	T	P	C	Course Type
Course Code	AGR E016	1	0	0	1	DSE

1. Course Objective:

The objective of this course is:

1. To provide knowledge on the biology, rearing, and management of beneficial insects, including honeybees, silkworms, and lac insects.
2. To develop an understanding of the role of pollinators, their biology, foraging behavior, and ecological importance.
3. To introduce the economic and ecological aspects of sericulture, apiculture, and lac culture.
4. To equip students with skills in identifying and managing pests, diseases, predators, and parasitoids in biological pest control.
5. To highlight the importance of beneficial insects like pollinators, weed killers, and scavengers in agriculture and ecological balance.

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	Bloom's Taxonomy level	Evaluation Method
1.	Recall and explain the biology, life cycles, ecological roles, and importance of beneficial insects such as honeybees, silkworms, and lac insects, including the role of pollinators in crop production.	1,2	Surprise Quiz
2.	Describe and apply methods of rearing, seasonal management practices, and commercial production techniques for honeybees, silkworms, and lac insects.	2,3	Mid Term
3.	Demonstrate the use of rearing appliances, equipment, disinfection methods, and mass multiplication techniques for predators and parasitoids used in biological pest control.	3	Assignment/ Project
4.	Analyze interactions among pollinators, host plants, pests, and diseases, and investigate causes of diseases in honeybees and silkworms to propose suitable management strategies.	4	Comp. Exam.
5.	Evaluate biological pest control strategies and develop sustainable, eco-friendly, and innovative approaches for improving commercial production of honey, silk, and lac.	5	Comp. Exam.

3. Syllabus:

Unit No	Content
UNIT 1	Importance of beneficial Insects, Bee keeping 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
UNIT II	Types of silkworm, 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, management, rearing appliances of mulberry silkworm and methods of disinfection
UNIT III	Species of Lac Insect, morphology, biology, host plant, lac production-seed lac, button lac, shellac, lac- product. Identification of major parasitoids and predators commonly being used in biological control.
UNIT IV	Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques
UNIT V	Important species of pollinator, weed killers and scavengers with their importance.

4. BOOKS:

- **Textbooks**

T1. Handbook of Entomology by T.V. Prasad Fourth Edition

T2 The Insects: Beneficial and Harmful Aspects by Dunston P. Ambrose

T2. Essentials of Agricultural Entomology by G.S. Dhariwal.

- **Reference books:**

R1. An Introduction to Entomology by P.D. Srivastav & R.P. Singh

R2. Elements of Entomology by Rajendra Singh & G.C. Sachan

6. Scheme of Evaluation: (Write evaluation components with weightage):

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam						
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 5

7. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	3	2	0	0	0	2	0	0	1
2	2	2	3	0	2	2	0	0	0
3	1	2	2	0	3	1	2	1	0
4	2	3	2	3	0	2	1	0	0
5	0	2	3	2	1	3	2	1	2

Course: Principles of Organic farming

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Principles of Organic farming	L	T	P	C	Course Type
Course Code	AGR E017	1	0	1	2	DSE

1. Course Objectives:

This course ensures that the students understand how:

- COb1** Provide a thorough understanding of organic farming principles, including soil management, crop rotation, and the role of biodiversity in sustainable agricultural systems
- COb2** Equip students with the knowledge to evaluate organic farming practices and certifications, enabling them to assess their feasibility and impact on local and global markets
- COb3** Foster innovation and problem-solving skills through the exploration of organic pest management techniques and organic fertilization methods that support crop productivity
- COb4** Encourage students to develop and implement organic farming projects, integrating theory with practical applications in a real-world farming context
- COb5** Cultivate an appreciation for the socio-economic and environmental implications of organic farming, preparing students to contribute to policy development and community awareness in sustainable agriculture

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	BT level	Evaluation component
Co1	Understand the fundamental principles, scope, and concepts of organic farming in India, including organic ecosystems and government/NGO initiatives promoting organic agriculture.	L1	Mid term
Co2	Explain organic nutrient resources, their fortification methods, restrictions on nutrient use, and criteria for selection of suitable crops and varieties for organic production.	L2	Surprise Quiz
Co3	Apply organic farming techniques for the management of nutrients, insects, pests, diseases, and weeds using appropriate ecological and sustainable practices.	L3	Mid term
Co4	Analyze the certification procedures under the National Programme for Organic Production (NPOP), and evaluate the economic viability, farm management aspects, and sustainability of organic farming systems.	L4	Practical/ End term
Co5	Design effective strategies for implementing, marketing, and promoting organic farming practices, including export opportunities, outreach programs, and farmer/consumer awareness initiatives.	L5 & L6	Practical/ End term

3. Syllabus:

Unit-1		Contact Hours: 02
Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture		

Unit-2		Contact Hours: 03
Organic ecosystem and their concepts; Organic nutrient resources and its fortification		
Unit-3		Contact Hours: 03
Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming;		
Unit-4		Contact Hours: 03
Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming;		
Unit-5		Contact Hours: 03
Processing, leveling, economic considerations and viability, marketing and export potential of organic products		
Practical	Suggested list of Exercises	
1	To utilize the organic farm residue for preparation of nutrient rich organic manure through composting.	
2	Quality estimation of compost.	
3	Estimation of soil organic carbon.	
4	To utilize the organic farm residue for preparation of nutrient rich organic manure through vermi-composting	
5	Estimation of cost of organic production system.	
6	To determine Quality considerations and certification of organic produce.	
7	Post-harvest management of organic produce.	
8	Study of different types of organic manures.	
9	Study of different types of bio fertilizers.	
10	To study about rhizobium and its different types.	
11	Weed management in organic farming.	
12	Visit to an organic farm.	
Suggested Readings Text Book	1. Principles of Organic Farming, S R Reddy, Kalyani Publishers, Ludhiyana. 2. Organic Farming for Sustainable Agriculture, Dilip Nandwani Springer Publications	

4. BOOKS:

Text Books:

T1. Principles of Organic Farming, S R Reddy, Kalyani Publishers, Ludhiyana.

T2. Organic Farming for Sustainable Agriculture, Dilip Nandwani Springer Publications

Reference Books:

R1. Organic Crop Production –Principles and Practices-Volume I. Principles and General Aspects, Jag Paul Sharma, Kalyani Publishers, Jalandhar.

R2. Organic Crop Production –Principles and Practices-Volume II. Crop Specific Organic Production Package, Jag Paul Sharma, Kalyani Publishers, Jalandhar.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 4

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes <input type="checkbox"/>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes <input type="checkbox"/>									
CO1	2	3	2	0	1	1	1	1	0
CO2	2	3	2	1	2	2	1	1	1
CO3	3	3	3	2	3	3	2	0	2
CO4	2	3	3	3	2	2	2	1	3
CO5	3	3	3	3	3	3	3	1	3

Course: Principles of Food Science and Nutrition

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Principles of Food Science and Nutrition	L	T	P	C	Course Type
Course Code	AGR E018	1	0	0	1	DSE

1. Course Objective:

The objective of this course is to:

- a) **Understand** the comprehensive knowledge in food science and nutrition focusing on principles and methods of food processing, preservation and enhancing product quality.
- b) **Identify** nutritional disorders and generating the management of balanced/ modified diets, Menu planning, New trends in food science and nutrition.
- c) **Illustrate** theoretical as well as practical knowledge about the methods of food processing, preservation and its importance in human diet.
- d) **Plan and design** projects focused on balanced/ modified diets, Menu planning that will minimize the nutritional disorders.
- e) **Analyze and compare** the benefits of different balanced/ modified diets, involves considering various factors such as nutritional value, food composition and chemistry, food microbiology, market demand and prepare students for advanced studies and research in food science, providing a strong foundation in new trends in food science and nutrition.

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	Bloom's Taxonomy level	Evaluation Method
1.	Recall and explain fundamental concepts of food science, including food composition, chemistry, microbiology, food processing, preservation, and their significance in human nutrition and health.	1,2	Surprise Quiz
2.	Demonstrate food processing, preservation techniques, and food safety measures by applying microbiological and quality control principles to ensure food safety and minimize spoilage.	3	Mid Term
3.	Differentiate balanced and modified diets and justify the role of energy metabolism by assessing carbohydrate, fat, and protein utilization under different physiological and nutritional conditions.	4	Assignment/ Project
4.	Evaluate the effectiveness of various food preservation methods in maintaining nutritional quality, shelf life, and compliance with food safety regulations and quality standards.	5	Comp. Exam.
5.	Design innovative diet plans and food products using modern food science technologies and market demand analysis to address nutritional disorders and entrepreneurial opportunities.	6	Comp. Exam.

3. Syllabus:

Unit No	Content
UNIT I	Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.).
UNIT II	Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavors, colors, miscellaneous bio-actives, important reactions).
UNIT III	Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods).
UNIT IV	Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).
UNIT V	Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

4. BOOKS:

- **Text Books:**
- **T1.** Minna Bagga and Swati Gupta, 2018. Principles of Food Science and Nutrition. Kalyani Publications, New Delhi.
- **Reference Books:-**
- **R1.** Handbook of Horticulture (Vol.1), ICAR, New Delhi.
- **R2.** Handbook of Horticulture (Vol.2), ICAR, New Delhi.

5. Scheme of Evaluation: (Write evaluation components with weightage):

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam						
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 5

6. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	3	2	0	0	0	2	0	0	1
2	2	2	2	0	3	2	3	1	0
3	2	3	2	2	0	3	0	0	0
4	1	2	2	3	1	2	3	0	0
5	0	2	3	2	3	2	1	2	2

Course: Production Technology for Ornamental Crops, MAP and Landscaping

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Production Technology for Ornamental Crops, MAP and Landscaping	L	T	P	C	Course Type
Course Code	AGR E019	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To know about scopes and importance of various ornamental crops, medicinal and aromatic plants and landscaping, their identification & classification and research opportunities in this field for better human health, nutrition and national economy.
COb2	To study cultivation practices of various ornamental crops, medicinal and aromatic plants in Uttarakhand including modern technology and recent advances in their improvement and case study of selected gardens of national importance.
COb3	To apply package of practices used in the production of ornamental crops, medicinal and aromatic plants including their packaging and marketing.
COb4	To develop entrepreneurial skills through processing and value addition in ornamental crops and MAP's produce & landscaping.
COb5	To develop a competitive teaching-learning environment for enabling students for higher studies in the field of horticulture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Identify ornamental crops, medicinal and aromatic plants (MAPs), cut and loose flowers, and state their uses and economic importance.	L1	Mid Term
CO2	Explain the importance of ornamental crops, medicinal and aromatic plants, landscaping, and different types and styles of gardens.	L2	Mid Term
CO3	Apply cultural practices for the production of ornamental crops and MAPs, and select suitable plants for rural and urban landscapes, indoor gardening, bonsai, hanging baskets, and post-culture uses.	L3	Case Studies/ Project/ Assignment
CO4	Analyze garden planning and layout principles, classify cut and loose flowers, and examine harvesting and post-harvest handling practices for quality maintenance.	L4 & L5	Practical Examination
CO5	Design innovative garden layouts and landscaping plans for rural and	L6	End Term

urban areas, and evaluate suitable ornamental crops and MAPs for processing and value addition.		Examination
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• **Syllabus:**

Unit-1		Contact Hours: 2
Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Important Ornamental and Medicinal and Aromatic Plants in Uttarakhand context. Identification, use of ornamental plants for the beautification of private and public places, styles of gardens, formal, informal etc.		
Unit-2		Contact Hours: 3
Principles of landscaping. Theory and practice of landscape and formal garden for various places. Case study of selected gardens of national importance. Planning and layout of various parts of garden, herbaceous and shrubby borders, lily pots, rock gardens etc.		
Unit-3		Contact Hours: 3
Ornamental plants for rural and urban areas, indoor gardening, post culture; bonsai, hanging baskets etc. Production technology of important cut flowers like rose, gerbera, carnation, lily, orchids, gladiolus, tuberose, chrysanthemum under protected and open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions.		
Unit-4		Contact Hours: 3
Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol		
Unit-5		Contact Hours: 3
Production technology of important aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.		
Practical	Suggested list of Exercises	
1	Identification of Ornamental plants.	
2	Identification of Medicinal and Aromatic Plants.	
3	Nursery bed preparation and seed sowing.	
4	Training and pruning of Ornamental plants.	
5	Planning and layout of garden.	
6	Seed Bed preparation and planting of MAP.	
7	To study about protected structures – care and maintenance.	
8	Intercultural operations in flowers and MAP.	
9	Harvesting of cut and loose flowers.	
10	Post harvest handling of cut and loose flowers.	
11	Processing of MAP.	

12	Visit to commercial flower/MAP unit.
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• **Books:**

Textbooks: -

- T3.** Jitender Singh, 2014. Basic Horticulture, 4th revised edition. Kalyani Publications, New Delhi.
T4. J.S. Arora, 2020. Introductory Ornamental Horticulture, 9th revised edition. Kalyani Publications, New Delhi.
T5. Abhinav Kumar, 2020. Production Technology for ornamental crops, medicinal, aromatic plants and landscaping. Kalyani Publications, New delhi.
T6. Srinivas puri, 2012. Medicinal plants importance and benefits. Sonali Publications. New Delhi.

Reference Books: -

R1. Handbook of Horticulture (Vol.1), ICAR, New Delhi.

R2. Handbook of Horticulture (Vol.2), ICAR, New Delhi.

• **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	1	0	1	0	0	1	0
CO2	2	3	2	1	1	1	1	2	0
CO3	2	2	1	2	3	2	2	1	1
CO4	1	2	1	1	2	3	1	0	2
CO5	0	1	2	3	2	2	3	1	3

Course: Production Technology for Fruit and Plantation Crops

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Production Technology for Fruit and Plantation Crops	L	T	P	C	Course Type
Course Code	AGR E020	1	0	1	2	DSE

Course Objective:

This course ensures that the students understand how:

COb1	To provide comprehensive understanding of the importance, scope, and economic significance of fruit and plantation crop industries in India and Uttarakhand, highlighting their role in nutritional security and rural livelihoods.
COb2	To develop knowledge and skills related to the origin, botany, soil and climatic requirements, cultivars, propagation methods, and planting practices of major fruit and plantation crops.
COb3	To impart practical understanding of care and management practices, including irrigation, nutrition, training, pruning, intercropping, harvesting, storage, and marketing for improving productivity and quality.
COb4	To familiarize students with the application of plant bioregulators and post-harvest technologies for enhancing shelf life, quality, and value addition of fruit and plantation crops.
COb5	To enable students to identify and manage insect pests and diseases, evaluate fruit trees, and plan, formulate, and evaluate commercial orchard projects for sustainable and entrepreneurial agriculture.

Course Outcomes:

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Recall and identify the importance, scope, and economic significance of fruit and plantation crop industries in India and Uttarakhand, including major fruit and plantation crops.	L1	Mid Term
CO2	Explain the origin, botany, soil and climatic requirements, important cultivars, and propagation methods of major fruit and plantation crops.	L2	Mid Term
CO3	Apply appropriate cultivation and care practices such as irrigation, nutrition, training, pruning, intercropping, harvesting, storage, and marketing for fruit and plantation crops.	L3	Case Studies/ Project/ Assignment
CO4	Analyze and evaluate nutrient deficiencies, major cultivation problems, insect-pest and disease incidence, and assess the role of plant bioregulators and post-harvest technologies in improving crop productivity and quality.	L4 & L5	Practical Examination
CO5	Design and formulate commercial orchard and plantation crop projects by integrating pest and disease management strategies, tree evaluation	L6	End Term

	principles, post-harvest handling, and economic feasibility for entrepreneurial agriculture.		Examination
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Syllabus

Unit No	Content
UNIT I	Importance and scope of fruit and plantation crop industries in India and Uttarakhand.
UNIT II	Cultivation practices of important fruit and plantation crops with reference to their origin, soil and climatic requirements; botany, important cultivars, plant propagation practices, resources and planting.
UNIT III	Care and management in respect of irrigation, nutrition and other cultural operations including training and pruning, nutrient deficiencies of fruit plant and their collection, intercropping, major cultivation problems and their control measures, harvesting, yield, storage and marketing.
UNIT IV	Application of plant bioregulators; post-harvest technology of plantation crops.
UNIT V	Management of major insect- pests and disease, principles and methods of evaluation of fruit trees, project formulation and evaluation, commercial orchard.
Practical	Suggested list of Exercises
1	To study about seed propagation.
2	Scarification and stratification of seeds.
3	Propagation methods for fruit crops.
4	Propagation methods for plantation crops.
5	Preparation of plant bio regulators and their uses
6	Identification of important pest and disease in fruit and plantation crops.
7	To practice various cultural operation in fruit trees.
8	.To identify nutrient deficiencies of fruit plant and their collection.
9	Management of major pest and disease in fruit trees.
10	To study the morphology of mango tree.
11	To study the morphology of guava tree.
12	Visit to common orchard.

Books:**Textbooks:**

T1: Chadha K.L., “Hand Book of Horticulture” I.C.A.R., New Delhi, First Edition 2001.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	1	0	1	1	1	2	0
CO2	2	3	1	0	2	1	1	2	0
CO3	2	3	2	1	3	2	1	1	1
CO4	1	3	2	1	2	3	2	1	1
CO5	1	2	2	3	2	2	3	1	3

Course: Landscaping

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Landscaping	L	T	P	C	Course Type
Course Code	AGR E021	1	0	1	2	DSE

1. Course Objective:

This course ensures that the students understand how:

COb1	To introduce students to the importance, scope, and principles of landscaping , including various garden styles and types , and to develop a fundamental understanding of landscape design concepts.
COb2	To familiarize students with garden components and adornments such as lawns, rockeries, water gardens, walkways, bridges, terrace and vertical gardens, and to understand the planning of gardens for special purposes .
COb3	To impart knowledge on the selection, propagation, planting schemes, and management of trees, shrubs, herbaceous perennials, climbers, creepers, annuals, and other ornamental plants used in landscape architecture.
COb4	To develop an understanding of pot plants, bio-aesthetic planning, and landscaping of urban, rural, and peri-urban areas , including public places such as schools, hospitals, transport hubs, industries, and institutional campuses.
COb5	To build skills in bonsai techniques, lawn establishment and maintenance , and the application of modern tools such as CAD for planning and designing functional, aesthetic, and sustainable landscape projects.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Identify and describe the importance, scope, principles, styles, and types of landscaping, including terrace and vertical gardening systems.	L1	Mid Term
CO2	Explain the components and special-purpose gardens, including lawns, rockeries, water gardens, walkways, bridges, and other constructed landscape features.	L2	Mid Term
CO3	Apply appropriate techniques for the selection, propagation, planting schemes, and management of trees, shrubs, climbers, creepers, annuals, palms, ferns, grasses, cacti, and pot plants used in landscaping.	L3	Case Studies/ Project/ Assignment
CO4	Analyze bio-aesthetic planning principles and landscaping requirements of urban, rural, and peri-urban areas, including public places such as schools, hospitals, transport hubs, institutions, and industries.	L4 & L5	Practical Examination
CO5	Design functional and sustainable landscape plans using bonsai principles, lawn establishment practices, and CAD tools for diverse locations and user needs.	L6	End Term Examination

3. Syllabus:

Unit 1:	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.
Unit 2:	Gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.
Unit 3:	Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents.
Unit 4:	Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping.
Unit 5:	Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.
Practical	Suggested list of Exercises
1	Identification of trees, shrubs, annuals, pot plants.
2	Propagation of trees, shrubs and annuals.
3	Care and maintenance of ornamental plants
4	Potting and repotting
5	Identification of tools and implements used in landscape design.
6	Training and pruning of plants for special effects
7	Lawn establishment and maintenance,
8	Layout of formal gardens.
9	Layout of informal gardens.
10	Designing of conservatory and lathe house.
11	Use of computer software.
12	Visit to important gardens/ parks/ institutes.

4. Books:

Textbooks

- T7.** Jitender Singh, 2014. Basic Horticulture, 4th revised edition. Kalyani Publications, New Delhi.
- T8.** J.S. Arora, 2020. Introductory Ornamental Horticulture, 9th revised edition. Kalyani Publications, New Delhi.
- T9.** Abhinav Kumar, 2020. Production Technology for ornamental crops, medicinal, aromatic plants and landscaping. Kalyani Publications, New Delhi.

5. Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2

Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	3	1	0	1	0	0	1	0
CO2	1	3	2	0	1	1	1	1	0
CO3	1	2	1	2	3	2	2	0	1
CO4	0	2	3	1	2	3	1	0	2
CO5	0	1	2	3	2	2	3	1	3

Course: Entrepreneurship Development and Business Communication

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Entrepreneurship Development and Business Communication	L	T	P	C	Course Type
Course Code	AGR E022	1	0	0	1	DSE

1. Course Objective:

The objective of this course is to:

- a) Understand the concept, characteristics, and development of entrepreneurs in agriculture.
- b) Analyze entrepreneurial motivation, SWOT analysis, and leadership skills.
- c) Understand government policies, institutional support, and financing mechanisms for agri-enterprises.
- d) Develop managerial, organizational, and problem-solving skills required for enterprise management.
- e) Apply project planning, supply chain, and quality management concepts in agribusiness

2. Course Outcomes:

At the end of this course, the students would be able to:

	Course Outcomes	Bloom's Taxonomy level	Evaluation Method
1.	Explain concepts of entrepreneurship, characteristics of entrepreneurs, and entrepreneurial development process	2	Surprise Quiz
2.	Analyze SWOT, achievement motivation, and impact of economic reforms on agribusiness	4	Mid Term
3.	Explain government policies, institutional support, and financing of agri-enterprises	2	Assignment/ Project
4.	Apply managerial, organizational, leadership, and problem-solving skills in enterprise management	3	Comp. Exam.
5.	Prepare agribusiness project plans incorporating supply chain and quality management principles	5,6	Comp. Exam.

3. Syllabus:

Unit No	Content
UNIT I	Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development.
UNIT II	Impact of economic reforms on Agribusiness/ Agri-enterprises, Entrepreneurial Development Process; Business Leadership Skills.
UNIT III	Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill.

UNIT IV	Financing of enterprise, Opportunities for agri- entrepreneurship and rural enterprise.
UNIT V	Supply chain management and Total quality management, Project Planning Formulation and report preparation.

4. BOOKS:

Text Books:

- Entrepreneurship Development and Business Communication, 2008, Vasanta V. Desai, Himalaya Publishing House
- Entrepreneurship Development and Business Communication, R.R. Chole, P.S. Kapse, P.D. Deshmukh. Scientific Publishers.

6. Scheme of Evaluation: (Write evaluation components with weightage):

Component	Adopted for this Course	Duration	Weightage	Venue	Remarks	Levels
Mid term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Assignment/ Case study	<input checked="" type="checkbox"/>	1 week	05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1 to 3
End Semester Practical Exam						
End Term Exam	<input checked="" type="checkbox"/>	3hr	50			Levels 1 to 5

7. Mapping of Course Outcomes with Program Outcomes:

Program outcome	a	b	c	d	e	f	g	h	i
Course Outcomes									
1	2	2	1	3	0	1	1	1	0
2	1	1	1	2	0	3	1	1	0
3	1	1	2	2	0	1	1	1	1
4	0	0	2	3	2	3	2	1	1
5	0	0	1	3	2	2	2	1	3

Course: Protected Cultivation and Secondary Agriculture

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Protected Cultivation and Secondary Agriculture	L	T	P	C	Course Type
Course Code	AGR E023	1	0	1	2	DSE

Course Objective:

This course ensures that the students understand how:

COB1	To provide a comprehensive understanding of greenhouse technology and its applications in agriculture.
COB2	To develop skills in planning, designing, and optimizing greenhouse structures for efficient crop production.
COB3	To impart knowledge of advanced engineering properties and their application in post-harvest technologies (PHT) for cereals, pulses, and oilseeds.
COB4	To educate on drying and dehydration techniques, including various methods and equipment used in agricultural settings.
COB5	To foster critical thinking and problem-solving abilities for identifying and resolving challenges in protected cultivation and secondary agriculture.

3. Course Outcomes:

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Recall and describe the types, characteristics, structures, and components of different greenhouse systems.	L1	Mid Term
CO2	Explain common environmental problems in greenhouses, greenhouse equipment and materials, and justify their selection for traditional and low-cost greenhouse constructions.	L2	Mid Term
CO3	Apply principles of greenhouse planning and design, including cooling, heating, irrigation systems, drying methods, and engineering concepts for post-harvest technologies of cereals, pulses, and oilseeds.	L3	Case Studies/ Project/ Assignment
CO4	Analyze the economic feasibility of greenhouse operations through cost estimation and economic analysis, and evaluate the performance of irrigation systems used in greenhouse crop production.	L4 & L5	Practical Examination
CO5	Design and propose independent agro-based projects integrating protected cultivation, post-harvest processing, drying technologies, and secondary agriculture concepts.	L6	End Term Examination

4. Syllabus:

Unit-1		Contact Hours: 02
Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment.		
Unit-2		Contact Hours: 03
Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.		
Unit-3		Contact Hours: 03
Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis.		
Unit-4		Contact Hours: 03
Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.		
Unit-5		Contact Hours: 03
Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.		
Practical	Suggested list of Exercises	
1	Study of different type of green houses based on shape.	
2	Determine the rate of air exchange in an active summer winter cooling system.	
3	Determination of drying rate of agricultural products inside green house.	
4	Study of green house equipments	
5	Visit to various Post Harvest Laboratories	
6	Determination of Moisture content of various grains by infrared moisture methods.	
7	Determination of engineering properties (shape and size, bulk density and porosity of biomaterials)	
8	Determination of Moisture content of various grains by moisture meter.	
8	Field visit to seed processing plant.	
10	Determination of Moisture content of various grains by oven drying methods.	
11	To study about machinery and equipments for drying/dehydration.	
12	Cost estimation and economic analysis of greenhouse.	

5. Books:**Textbooks:****Reference books:**

- Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	3	0	0	1	0	0	1	0
CO2	1	3	1	0	1	2	1	1	0
CO3	1	2	1	1	3	2	2	0	1
CO4	0	1	1	2	2	3	2	0	2
CO5	0	1	2	3	2	2	3	1	3

Course: Farm Management, Production & Resource Economics

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Farm Management, Production & Resource Economics	L	T	P	C	Course Type
Course Code	AGR E024	1	0	1	2	DSE

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the meaning, scope, and principles of farm management and its relationship with other agricultural sciences.
COb2	To develop understanding of production economics, cost concepts, farm income measures, and efficiency analysis in crop and livestock enterprises.
COb3	To impart knowledge on farm records, accounts, farm planning, budgeting, and decision-making tools for effective farm management.
COb4	To familiarize students with concepts of risk, uncertainty, and insurance mechanisms in agricultural production.
COb5	To explain resource economics concepts, externalities, and management of common property resources for sustainable agriculture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the meaning, objectives, principles of farm management, types of farms, and factors determining farm size and organization.	L2	Mid Term
CO2	Analyze production functions, factor–product, factor–factor, and product–product relationships, and apply economic principles in farm decision-making.	L4	Mid Term
CO3	Compute cost concepts, farm income measures, and evaluate profitability and technical and economic efficiency of farm enterprises.	L3	Case Studies/ Project/ Assignment
CO4	Apply farm planning, budgeting techniques, and risk management strategies including crop and livestock insurance in farm business decisions.	L3	Practical Examination
CO5	Evaluate issues related to resource economics, externalities, and management of common property resources for sustainable agricultural development.	L5	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
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.		
Unit-2		Contact Hours: 3
Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage		
Unit-3		Contact Hours: 3
Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income. 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.		
Unit-4		Contact Hours: 3
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. 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		
Unit-5		Contact Hours: 3
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.		
Practical	Suggested list of Exercises	
1	To workout Cost of cultivation in maize crop, by surveying a maize farmer from surrounding area.	
2	To Prepare a farm layout, for x Ha of land with given considerations, facilities, geography and marketing facilities.	
3	Problem on Law of Diminishing Marginal Returns.	
4	To work out cost of fencing in the given area.	
5	Problem on Cost Concept.	
6	Problem on Law of Equi-Marginal Return.	
7	Problem based on Factor-Factor Relationship.	

8	Problem on Computation of depreciation cost of farm assets.
9	Problem on Determination of least cost combination of inputs.
10	Problem on Problem on Selection of most profitable enterprise combination.
11	To workout Cost of cultivation in maize crop, by surveying a maize farmer from surrounding area.

• **Books:**

Textbooks: -

T5. Dhondyal. S.P. "Farm Management -An Economic Analyst". Friends Publications. Merrut.

T6. Doll. J .P & Ozazem. F. "Production Economics Theory with application" Grid Inc. Columbus Chio.

Reference Books: -

R1. Johl. S.S. and Kapoor. T .P. "Fundamental of farm Business Management". Kalyani Publishers. New Delhi.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	0	0	0	1
CO2	2	3	2	0	0	0	0	0	0
CO3	2	3	2	1	0	0	0	0	0
CO4	2	3	3	0	0	1	0	0	0
CO5	2	3	3	0	0	3	0	0	2

Course: Communication Skills and Personality Development

Program	B.Sc. (Hons.) Agriculture	Semester				I
Course Name	Communication Skills and Personality Development	L	T	P	C	Course Type
Course Code	AGR S103	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	To demonstrate comprehension of advanced vocabulary and grammatical concepts (e.g., articles, prepositions, verb forms) essential for effective communication in academic and professional contexts.
COb2	To interpret and summarize various texts, distinguishing between different types of vocabulary (e.g., antonyms, synonyms) and grammatical structures, applying them appropriately in written and spoken communication.
COb3	To apply knowledge of vocabulary enrichment and grammatical rules to enhance their written communication skills, including paragraph writing, precise writing, report writing, and proposal writing, with a focus on professional style and format.
COb4	To analyze and evaluate their own communication strengths and weaknesses, using feedback to refine their skills in CV and job application writing, synopsis preparation, and interview techniques.
COb5	To design and execute independent projects that require effective communication strategies, integrating language proficiency, interpersonal skills, and presentation techniques to address real-world challenges in agriculture and related fields.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level	Evaluation component
CO1	Recall and identify key concepts of communication skills, personality development, reading comprehension strategies, vocabulary building, and functional grammar.	L1	Mid Term
CO2	Interpret, summarize, and explain information effectively in written and spoken forms by applying principles of functional grammar and professional communication.	L2	Mid Term
CO3	Apply communication skills to prepare professional documents such as paragraphs, précis, reports, proposals, CVs, cover letters, and synopses relevant to agriculture and allied fields.	L3	Case Studies/ Project/ Assignment

CO4	Analyze communication challenges, evaluate personal communication effectiveness through feedback and reflection, and formulate appropriate solutions for improvement.	L4	Practical Examination
CO5	Develop leadership, entrepreneurship, and professional competencies by designing projects, presentations, and innovative communication strategies for career advancement and sustainable agricultural development.	L5	End Term Examination

3. Syllabus:

Unit-1		Contact Hours: 02
Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words.		
Unit-2		Contact Hours: 03
Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration.		
Unit-3		Contact Hours: 03
Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing.		
Unit-4		Contact Hours: 03
Preparation of Curriculum Vitae and Job applications. Synopsis Writing.		
Unit-5		Contact Hours: 03
Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process		
Practical	Suggested list of Exercises	
1	Body language	
2	Pronunciation Key	
3	News reading	
4	Group discussion	
5	Mock interview	
6	A test of vocabulary range	
7	Developing oral communication skills, Intonation	

8	Speech & debate
9	Presentation Skills
10	Intonation

4. Suggestive Readings:

Reference Books:

R1. Soft Skills by K. Alex. S Chand Publications.

R2. English Language Communication Skills by Rajesh Kumar. Cengage Learning.

R3. Remedial English by Rajhans Gupta. Pragati Publications.

R4. Body Language by Allen Pease. Manjul Publishing House.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	0	2	2	0	1	1	0	2	0
CO2	1	3	2	1	1	2	1	2	1
CO3	1	2	3	2	2	2	2	1	2
CO4	1	2	3	2	2	3	2	1	2
CO5	2	3	3	3	3	3	3	2	3

Course: Rural Sociology & Educational Psychology

Program	B.Sc. (Hons.) Agriculture	Semester				I
Course Name	Rural Sociology & Educational Psychology	L	T	P	C	Course Type
Course Code	AGR S105	1	0	0	1	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	Acquaintance with the rural social structure.
COb2	Acquaintance with Rural Social Instructions and knowledge of Projects formation and execution
COb3	Acquaintance with various Rural Development Programmes and ability to identify rural needs
COb4	Understand the basics of Educational Psychology
COb5	Understand the basics of human needs and motivational theories.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Differentiate between rural and urban societies and recall major rural development programmes, values, and social systems.	L1
CO2	Work effectively in rural areas by adapting to local value systems and applying problem-solving and conflict-management skills to create win-win situations.	L2
CO3	Assist rural communities by disseminating agricultural technologies and educating farmers to improve agri-production and livelihoods.	L3
CO4	Identify and analyze the needs, problems, and learning capacities of rural people and develop appropriate strategies for different learner groups.	L4
CO5	Design and implement participatory extension and motivational strategies to mobilize rural masses and promote sustainable rural development.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 15
Concepts, methods, tools, characteristics of rural society and people; rural – urban continuum and differences, Rural social structure: interaction, processes, institutions groups.		
Unit-2		Contact Hours: 05

Rural social stratification: status, roles, class, castes etc. Panchayati Raj and Block Development Organizations as rural peoples participative agencies for planned development, Specific, programs for rural area upliftment/employment in the Uttarakhand and India: JRY, IAT, EAS, MWS, IRDP, GKY, DWCRA, TRYSEM, DPAP, DDP, NSAP, Land reforms, etc.		
Unit-3		Contact Hours: 05
Council for Advancement of peoples Action and Rural Technology (CAPART). National Fund for Rural Development (NFRD), NGOs/Voluntary Sector.		
Unit-4		Contact Hours: 15
Conceptual/Clarifications on educational psychology, Psychology of individual differences; MA & IQ; the gifted, Slow Learner and Socially disadvantaged child.		
Unit-5		Contact Hours: 05
Learning and motivation, mental hygiene and adjustment, guidance and counseling.		

4. Suggestive Readings:

Text Books:

T1. Sagar Mondal, A Text Book of Rural Sociology and Educational Psychology, Kalyani Publishers, New Delhi.

T2. Sagar Mondal and GL Ray, Text book on Rural Development Entrepreneurship and Communication Skills, Kalyani Publications. New Delhi.

References Book:

R1. Desai, AR. Rural Sociology, Popular Prakashan, Navi Mumbai

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	2 hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes → Course Outcomes ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	3	2	0	1	1	1	2	0
CO2	2	3	3	1	2	3	1	1	2
CO3	3	3	3	2	3	3	2	1	2
CO4	2	3	3	2	2	3	2	1	3
CO5	3	3	3	3	3	3	3	1	3

Course: Soil and Water Conservation Engineering

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Soil and Water Conservation Engineering	L	T	P	C	Course Type
Course Code	AGR S107	1	0	1	2	SEC

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the concepts, scope, and importance of soil and water conservation in sustainable agriculture.
COb2	To explain the causes, agents, and processes of soil erosion by water and wind.
COb3	To impart knowledge on estimation and measurement of soil loss using standard equations and field techniques.
COb4	To familiarize students with engineering and agronomic measures for erosion control and water harvesting.
COb5	To develop understanding of region-specific soil and water conservation practices, especially for hill agriculture.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the fundamentals of soil and water conservation, causes and agents of soil erosion, and the mechanics of water and wind erosion.	L2	Mid Term
CO2	Describe different forms of water erosion, gully classification, soil loss estimation using the Universal Soil Loss Equation (USLE), and soil loss measurement techniques.	L2	Mid Term
CO3	Apply principles of erosion control through agronomic and engineering measures such as contouring, strip cropping, bunding, bench terracing, and grassed waterways.	L3	Case Studies/ Project/ Assignment
CO4	Analyze wind erosion processes, types of soil movement, and evaluate appropriate wind erosion control measures under different agro-climatic conditions.	L4	Practical Examination
CO5	Evaluate water harvesting techniques and region-specific soil and water conservation practices adopted in hill regions,	L5	End Term

particularly in Uttarakhand.	Examination
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• **Syllabus:**

Unit-1		Contact Hours: 2
Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion.		
Unit-2		Contact Hours: 3
Water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques.		
Unit-3		Contact Hours: 3
Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design.		
Unit-4		Contact Hours: 3
Water harvesting and its techniques. Important practices of soil and water conservation adopted mainly in Hill region of Uttarakhand.		
Unit-5		Contact Hours: 3
Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.		
Practical	Suggested list of Exercises	
1	To study the general status of soil conservation in India	
2	To study the surveying instruments	
3	To study the leveling instruments	
4	To study the gully plug, nala bund, check dams and K.T.weirs	
5	To study the problem of wind erosion	
6	Estimation of soil loss (USLE)	
7	Preparations of contour maps	
8	Studies of grassed waterways	
9	Studies of graded bunds	
10	Studies of contour bund and compartmental bunding	
11	Studies of terraces	
12	Studies of CCT and staggered trenches	

• **Books:**

Textbooks: -

T2. Mal BC. Introductory Soil & Water Conservation Engineering by, Kalyani Publishers. New Delhi

Reference Books: -

• **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1 hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	2	0	0	1
CO2	3	3	0	2	1	2	0	0	0
CO3	2	2	3	0	2	3	1	1	0
CO4	2	3	2	3	0	2	1	0	0
CO5	1	2	3	2	0	3	2	1	2

Course: Fundamentals of Agricultural Extension Education

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Fundamentals of Agricultural Extension Education	L	T	P	C	Course Type
Course Code	AGR S111	1	0	1	2	SEC

• **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the meaning, philosophy, principles, and historical development of extension education and rural development in India.
COb2	To develop understanding of human behaviour, teaching–learning processes, and programme planning in extension work.
COb3	To familiarize students with extension administration, leadership development, organizational structure, and coordination mechanisms.
COb4	To provide knowledge of evaluation methods and critical analysis of extension programmes.
COb5	To impart awareness of major rural development programmes and the role of institutions, voluntary organizations, and women in rural development.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the concept, philosophy, objectives, principles, and historical development of extension education, including formal and non-formal education systems and components of human behaviour.	L2	Mid Term
CO2	Describe the principles and steps of the teaching–learning process, learning situations, programme planning process, and the role of Panchayati Raj Institutions in extension programme planning.	L2	Mid Term
CO3	Apply concepts of rural leadership, extension administration, organizational principles (POSDCORB), coordination, and teamwork in planning and implementation of extension activities.	L3	Case Studies/ Project/ Assignment
CO4	Analyze extension evaluation methods, principles, techniques, and critically assess various extension and rural development programmes.	L4	Practical Examination
CO5	Evaluate major agricultural and rural development programmes and assess the role of voluntary organizations, women, and institutions in rural development at national and state (Uttarakhand) levels.	L5	End Term Examination

- **Syllabus:**

Unit-1		Contact Hours: 2
Meaning, concept and process of extension education, objectives, principles and philosophy of extension. History of extension work. Education-formal and non-formal. Components of behavior-knowledge, attitude, skills and motivation. Principles and steps in teaching learning process, learning situation, Implications of		

teaching.		
Unit-2		Contact Hours: 3
Concept need and steps in programme planning. Principles of programme planning, programme planning process. Panchayati Raj Institute, reorganization and its role in programme planning. Extension evaluation its meaning, principles, steps, techniques and criteria. Critical analysis of various extension programme.		
Unit-3		Contact Hours: 3
Meaning and importance of rural leadership, Types, selection and qualities, training of leadership. Meaning of administration, public administration and extension administration. Coordination and team work. Organization POSDCORB, organization and management of NES and reorganized extension system.		
Unit-4		Contact Hours: 3
Rural development programme: an over view of CD programme before 1952, agricultural/rural development programme ADP, LAAP, CADP, HYVP, SFDA, hill area development programme, integrated tribal development project, integrated dryland farming project, integrated child development scheme.		
Unit-5		Contact Hours: 3
IRDP, TRYSEM, JRY, DWCRA, mahila uthan yojana, Sunishchit rojgar yojana. Role of voluntary organizations in rural development, women in agriculture and rural development of the country and Uttarakhand state.		
Practical	Suggested list of Exercises	
1	Visit to block / Extension training centre.	
2	Acquaintance with university extension system	
3	Study of rural Development Programmes in villages.	
4	Evaluation of Extension programmes.	
5	Visit and study of Panchayati Raj institutes	
6	To study tool of Extension communication	
7	To study techniques of conducting effective Method Demonstration	
8	To study techniques of conducting effective Result Demonstration	
9	To study techniques of conducting effective Farmer Meetings	
10	To study effectiveness of various Govt. schemes intending extension of agricultural Techniques, by means of Rural Survey.	
11	Considerations for effective questionnaire and schedule.	
12	To study techniques of farmer's motivation.	

- **Books:**

Textbooks: -

T1. Dhama, O.O., Communication & Extension. Ram Prasad & Sons, Agra

T2.Reddy, A.A. Extension Education, Shree Lankshmi Press, Bapatla, Guntur (A.P.).

T3.Shrivastava J.P. Prasarki. Extension Amen Publishing House, Meeruth).

Reference Books: -

R1. A.K. Singh, Lakhan Singh, R. Ray Burman. Dimensions of Agricultural Extension,

R2. A.W. Vanden Ban, H.S. Hawkins, Agricultural Extension

R3. G.L. Ray, Extension Communication and Management.

• **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	2	0	0	1
CO2	2	2	2	0	0	2	0	1	0
CO3	2	2	3	0	0	2	3	3	0
CO4	2	3	2	3	0	1	1	0	0
CO5	1	2	3	2	0	3	2	1	2

Course: Crop Production Technology-I (Kharif crops)

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Crop Production Technology-I (Kharif crops)	L	T	P	C	Course Type
Course Code	AGR S201	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	Understand the scientific cultivation methods along with potential research opportunities of different Kharif season crops (cereal crops, oilseed crops, pulse crops, fibre crops & forage crops) in India with special reference to Uttarakhand.
COb2	Identify the pest and disease of different kharif season crops (cereals crops, oilseed crops, Pulse crops, fibre crops & forage crops) and generating the management of pest and disease through modern technology.
COb3	Illustrate theoretical as well as practical knowledge about the production techniques of different Kharif season crops (cereal crops, oilseed crops, pulse crops, fibre crops & forage crops) and its importance in agriculture and national economy.
COb4	Plan and design independent research projects focused on different Kharif season crop (cereal crops, oilseed crops, pulse crops, fibre crops & forage crops).
COb5	Analyze and compare the benefits of different Kharif season crop (cereal crops, oilseed crops, pulse crops, fibre crops & forage crops) involves considering various factors such as nutritional value, market demand, agronomic characteristics, environmental impact, and socio-economic implications.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
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CO1	Recall the origin, geographical distribution, economic importance, and classification of major Kharif crops including cereals, pulses, oilseeds, fibre, and forage crops.	L1
CO2	Explain the soil and climatic requirements, varieties, cultural practices, water management, and production technologies of Kharif crops in India with special reference to Uttarakhand.	L2
CO3	Apply agronomic principles to calculate fertilizer requirements, implement nutrient management, and adopt suitable crop cultivation and protection practices including integrated pest and disease management.	L3
CO4	Analyze crop planning, post-harvest handling, yield performance, and compare the relative advantages, challenges, and economic benefits of different Kharif crop groups for efficient decision-making.	L4
CO5	Design sustainable crop production strategies and independent research or innovation projects integrating scientific principles, resource-use efficiency, and modern technologies to enhance productivity and profitability of Kharif crops.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 2
Origin, geographic distribution, economic importance, Cultivation (soil and climatic requirement, varieties, cultural practices, yield and productivity of kharif crops in India and Uttarakhand), like Cereals-rice, maize, sorghum, pearl millet and finger millet.		
Unit-2		Contact Hours: 3
Origin, geographic distribution, economic importance and cultivation of Pulses – pigeon pea, mungbean and urdbean.		
Unit-3		Contact Hours: 3
Origin, geographic distribution, economic importance and cultivation of Oilseeds-groundnut, sesame and soybean.		
Unit-4		Contact Hours: 3
Origin, geographic distribution, economic importance and cultivation of Fibre crops- cotton, jute and sunhemp.		
Unit-5		Contact Hours: 3
Origin, geographic distribution, economic importance and cultivation of Forage crops -sorghum, maize, cowpea, cluster bean and napier.		
Practical	Suggested list of Exercises	
1	Identification of seeds of different <i>kharif</i> crops and other inputs	
2	Sowing methods of different <i>kharif</i> crops	
3	Rice nursery preparation and its transplanting	
4	Seed bed preparation for major <i>kharif</i> crops	
5	Calculation of seed requirement for <i>kharif</i> crops	

6	Methods of fertilizer application in crops
7	Identification of weeds in major <i>kharif</i> crops
8	Methods of irrigation application in various crops
9	Judging physiological maturity in standing crops
10	Study of yield contributing characters, yield calculation and harvest index of <i>kharif</i> crops
11	Method of harvesting of <i>kharif</i> crops
12	Yield estimation of <i>kharif</i> crops

4. Suggestive Readings:

Text Books:

T1. Dr. Rajendra Prasad, Textbook of Field Crops Production Foodgrain Crops, Volume-I, ICAR, New Delhi, Eleventh Reprint of Revised Edition, 2021

T2. Dr. Rajendra Prasad, “Textbook of Field Crops Production-Commercial Crops”, Volume-II, ICAR, New Delhi, Eight Reprint of Revised Edition, 2021.

Reference Books:

R1. “Handbook of Agriculture”, ICAR, New Delhi, Sixteenth Reprint of Sixth Edition, 2021

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									

CO1	3	2	0	0	1	0	0	1	0
CO2	3	3	1	0	2	1	1	1	0
CO3	3	2	1	1	3	3	1	0	1
CO4	2	2	1	2	2	3	2	1	2
CO5	2	2	2	3	3	3	2	2	3

Course: Farm Machinery and Power

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Farm Machinery and Power	L	T	P	C	Course Type
Course Code	AGR S204	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	To make the student acquainted with commonly used machines / implements/ tools used in farming.
COb2	To develop an insight into the ever-growing need of farm power, its various sources, feasibility and related environmental concerns.
COb3	To familiarize the students with the underlying principle, standard operating procedures, maintenance, safety and precautions for various farm machinery.
COb4	To develop capacity to plan & decide, the most suitable technology, involving judicious selection of available resources, feasibility and sustainability.
COb5	To understand basics of tractor engine, its various systems, selecting the type of tractor best suited, basic operation and maintenance.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand the principles of farm mechanization, mechanical advantage, and the theoretical and practical concepts of various farm implements, machinery, and tractor systems.	L1
CO2	Select appropriate farm machinery, implements, tractor models, and technologies suitable for specific crops, soil conditions, and farm sizes.	L2
CO3	Operate farm machinery and tractors efficiently with proper skills, while applying safety measures and performing routine repair and maintenance.	L3

CO4	Analyze machinery performance, field efficiency, operational costs, and environmental impacts, including concerns related to fossil fuels and the need for renewable energy alternatives.	L4
CO5	Design farm mechanization plans and machinery management strategies to enhance productivity, sustainability, and profitability of agricultural operations.	L5

3. Syllabus:

Unit-1		Contact Hours: 15
Farm power in India: sources, I.C engines, working principles.		
Unit-2		Contact Hours: 05
Two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine.		
Unit-3		Contact Hours: 05
Tractors, Types, Selection of tractor and cost of tractor power.		
Unit-4		Contact Hours: 15
Tillage implements: Primary and Secondary tillage implements, Implements for intercultural operations, seed drills, paddy transplanters.		
Unit-5		Contact Hours: 05
Plant protection equipment and harvesting equipment; Equipment for land development and soil conservation.		
Practical	Suggested list of Exercises	
1	Study of different components of I.C. Engine.	
2	Study of working of two stroke engine	
3	Study of Spring Tine Cultivator.	
4	Study of Disk Harrow.	
5	Study various parts of Tractor.	
6	Study of Parts, adjustments operation and Repairs, of Knapsack sprayers.	
7	Study of Harvesting Implements (Mover, Reaper)	
8	Study of seed cum ferti drill, metering mechanism and calibration.	
9	Study of Paddy Transplanter.	
10	Tractor Driving and operating controls.	
11	To study 3 point hitch attachment of implements in tractors and use of hydraulic system.	

4. Suggestive Readings:

Text Books:

T1. Jagdishwar Sahay, Elements of agricultural engineering, Standard Publishers, New Delhi.

T2. Ojha, T.P. and Michael, A.M., Principles of agricultural engineering Vol 1, Jain Brothers Pub. New Delhi.

T3. Nakra, C.P. Farm Machines and Equipment by Dhanpat Rai Pub, Co. New Delhi.

T4. Sharma, DN, Jain, M, Lohan, SK. Farm Power and Machinery, Jain Brothers, New Delhi

Reference Books:

R1. A Hand Book of Agricultural Engineering. ICAR Publication, New Delhi.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	0	0	1	1	0	1	0
CO2	2	2	1	2	3	2	2	0	2
CO3	2	2	3	1	3	3	1	0	1
CO4	1	2	2	2	2	3	2	1	2
CO5	2	2	2	3	3	3	2	1	3

Course: Production Technology for Vegetables and Spices

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Production Technology for Vegetables and Spices	L	T	P	C	Course Type
Course Code	AGR S205	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	To know about scopes and importance of various vegetables and spices, their identification & classification and research opportunities in this field for better human health, nutrition and national economy.
COb2	To study cultivation practices and identify physiological disorders, diseases and insect pests and control measure of various vegetables in Uttarakhand including modern technology and recent advances in improvement of vegetables and spices production.
COb3	To apply package of practices used in the production of vegetable crops including their packaging and marketing.
COb4	To develop entrepreneurial skills through vegetable production.
COb5	To develop a competitive teaching-learning environment for enabling students for higher studies in the field of horticulture.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcomes	BT level
CO1	Identify various vegetable and spice crop seeds and classify different types of vegetable farming systems.	L1
CO2	Explain the importance of vegetables and spices in human nutrition, health, and the national economy along with the basic principles of their production.	L2
CO3	Apply appropriate cultural practices and production technologies for vegetable and spice crops, considering factors affecting growth, yield, and quality.	L3
CO4	Analyze pest and disease infestation, harvesting indices, and maturity stages of vegetable crops and recommend suitable management and harvesting practices.	L4
CO5	Design effective post-harvest management, grading, packaging, and marketing strategies to enhance shelf life, quality, and profitability of vegetable and spice crops.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 2
Importance of vegetables and spices in human nutrition and national economy, factors effecting vegetable productivity viz. light, temperature, moisture, oxygen, CO ₂ mineral nutrients, soil reaction, disease and insect		

pests.		
Unit-2		Contact Hours: 02
Types of vegetable farming; types of classification of vegetable viz, botanical, classification, based on hardiness, parts used, duration of crop.		
Unit-3		Contact Hours: 03
Weed management, seed production, harvesting and marketing.		
Unit-4		Contact Hours: 03
Cultivation practices (time of sowing, nursery management, transplanting, sowing/planting distance, recommended cultivars, seed rate, manure and fertilizers doses, harvesting, and storage. Physiological disorders, diseases and insect pests and their control measure) of various vegetable crops namely potato, tomato, onion, garlic, okra, sweet corn, root crops and leafy vegetables.		
Unit-5		Contact Hours: 04
Cultivation practices of various vegetable crops namely pea, beans, cucurbitaceous crops-pumpkin, bottle gourd, sponge gourd, ridge gourd, pointed gourd, bitter gourd, cucumbers etc		
Practical	Suggested list of Exercises	
1	Identification of various vegetable crops.	
2	Identification of various crop seeds of vegetable and spices.	
3	To study the morphological character of vegetables.	
4	To study the morphological character of spices.	
5	Transplanting of vegetable seedlings and direct seed sowing in the field.	
6	Raising of vegetable seed crops.	
7	To study the seed extraction in vegetable crops.	
8	Harvesting indices of different vegetable crops.	
9	Grading and packaging of vegetables.	
10	To study the economics of vegetable production.	
11	Identification of symptoms caused by nutrient deficiency in vegetable crops.	

4. Suggestive Readings:

Text Books:

T1. MS Dhaliwal, Handbook of Vegetable Crops, Kalyani Publications, New Delhi.

T2. BR Choudhary, Vegetables, Kalyani Publications, New Delhi.

T3. S Thamburaj and N Singh, Textbook of vegetables, tuber crops and spices, ICAR, New Delhi.

Reference Books:-

R1. Handbook of Horticulture (Vol.1), ICAR, New Delhi.

R2. Handbook of Horticulture (Vol.2), ICAR, New Delhi.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	1	0	0	1	0
CO2	2	3	2	1	1	1	1	1	0
CO3	2	3	1	2	3	2	1	0	1
CO4	1	2	1	1	2	3	1	0	1
CO5	1	2	2	3	2	2	2	1	3

Course: Crop Production Technology –II (*Rabi Crops*)

Program	B.Sc. (Hons.) Agriculture				Semester				
Course Name	Crop Production Technology –II (<i>Rabi Crops</i>)				L	T	P	C	Course Type
Course Code	AGR S209				1	0	1	2	SEC

- **Course Objective:**

This course ensures that the students understand how:

COb1	To acquaint students with the origin, distribution, and economic importance of major rabi crops grown in India and Uttarakhand.
COb2	To impart knowledge on soil and climatic requirements, varieties, and cultural practices of rabi cereals, pulses, oilseeds, sugar crops, and regional crops.
COb3	To develop understanding of yield attributes, productivity, and regional adaptability of important rabi crops.
COb4	To familiarize students with medicinal, aromatic, forage, and industrial crops of regional importance.
COb5	To enable students to apply scientific crop production practices for sustainable and profitable rabi crop cultivation.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Describe the origin, geographic distribution, and economic importance of major rabi crops including cereals, pulses, oilseeds, sugar crops, and regional crops of India and Uttarakhand.	L2	Mid Term
CO2	Explain soil and climatic requirements, varieties, and cultural practices of rabi cereals (wheat, barley, triticale) and pulses (chickpea, lentil, pea, French bean).	L2	Mid Term
CO3	Explain cultivation practices, yield, and productivity of rabi oilseeds (rapeseed–mustard, sunflower, safflower, linseed) and sugar crops (sugarcane and sugarbeet).	L2	Case Studies/ Project/ Assignment
CO4	Apply appropriate production technologies for regional medicinal, aromatic, forage, and industrial crops such as mentha, lemongrass, citronella, palmarosa, isabgol, potato, tobacco, berseem, lucerne, and oat.	L3	Practical Examination
CO5	Evaluate crop suitability, productivity, and economic feasibility of different rabi crops under diverse agro-climatic conditions of India and Uttarakhand for sustainable farming systems.	L5	End Term Examination

- **Syllabus:**

Unit-1		Contact Hours: 2
Origin, geographic distribution, economic importance, Cultivation (soil and climatic requirement, varieties, cultural practices, yield and productivity) of <i>rabi</i> crops in India and Uttarakhand like Cereals: wheat, barley		

and triticale		
Unit-2		Contact Hours: 3
Origin, geographic distribution, economic importance, Cultivation (soil and climatic requirement, varieties, cultural practices, yield and productivity) of <i>rabi</i> crops in India and Uttarakhand like Pulses: chickpea, lentil, pea, French bean.		
Unit-3		Contact Hours: 3
Origin, geographic distribution, economic importance, Cultivation (soil and climatic requirement, varieties, cultural practices, yield and productivity) of <i>rabi</i> crops in India and Uttarakhand like Oil seeds- rapeseed and mustard, sunflower, safflower and linseed.		
Unit-4		Contact Hours: 3
Origin, geographic distribution, economic importance, Cultivation of <i>rabi</i> crops in India and Uttarakhand like Sugar crops- sugarcane and sugarbeet.		
Unit-5		Contact Hours: 3
Origin, geographic distribution, economic importance, Cultivation (soil and climatic requirement, varieties, cultural practices, yield and productivity) of Regional medicinal and aromatic crops such as mentha, lemon grass, citronella, palmarosa, Isabgol, potato and tobacco, Forage crops berseem, Lucerne and Oat.		
Practical	Suggested list of Exercises	
1	Identification of seeds of different <i>rabi</i> crops and other inputs	
2	Sowing methods of different <i>rabi</i> crops	
3	Seed bed preparation for major <i>rabi</i> crops	
4	Fertilizer application methods in <i>rabi</i> crops	
5	Calculation of seed requirement for <i>rabi</i> crops	
6	Identification of weeds in major <i>rabi</i> crops	
7	Study of weed control methods	
8	Methods of irrigation application in various crops	
9	Study of morphological characteristics of wheat, sugarcane, chickpea and mustard	
10	Study of yield contributing characters, yield calculation and harvest index of wheat crops	
11	Yield estimation of sugarcane crops	
12	Visit to research stations related to <i>rabi</i> crops	

• **Books:**

Textbooks: -

T1. Chhidda Singh. Crop Production Oxford & IBH Publications.

T2. Rajender Prasad. Text book of field crops production, DKMA, ICAR, N.D.

Reference Books: -

R1. Hand Book of Agriculture: ICAR

R2. C. Thakur. Scientific crop production

R3. Y.M. Iyer. Field Crops

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	0	0	0	0	1	0	0	1
CO2	3	2	0	0	0	2	0	0	0
CO3	3	2	0	0	0	2	0	0	0
CO4	2	2	3	0	2	3	0	1	0
CO5	2	3	3	2	0	3	1	1	2

Course: Principles of Seed Technology

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Principles of Seed Technology	L	T	P	C	Course Type
Course Code	AGR S210	1	0	1	2	SEC

• **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the concept, definition, and importance of seeds and seed technology in crop improvement and agricultural production.
COb2	To impart knowledge on seed quality, classes of seed, genetic purity maintenance, and foundation and certified seed production.
COb3	To familiarize students with seed certification systems, seed legislation, and quality control mechanisms.
COb4	To develop understanding of seed drying, processing, testing, treatment, storage, and pest and disease management during storage.
COb5	To provide insight into seed marketing systems, policies, and the role of national and international organizations in seed trade.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the concept, importance, and principles of seed science and technology, causes of seed deterioration, and methods for maintaining genetic purity during seed production.	L2	Mid Term
CO2	Describe seed quality parameters, characteristics of good quality seed, classes of seed, and foundation and certified seed production techniques for cereals, pulses, oilseeds, fodder, and vegetable crops.	L2	Mid Term
CO3	Explain seed certification procedures, seed legislation (Seed Act, Seeds Control Order), duties of seed inspectors, and methods for varietal identification and detection of GM crops.	L2	Case Studies/ Project/ Assignment
CO4	Apply seed drying, processing, testing, treatment, packing, and storage techniques and implement measures for pest and disease management to maintain seed quality and longevity.	L3	Practical Examination
CO5	Evaluate seed marketing systems, production and marketing strategies of public and private sectors, and the role of WTO and OECD in national and international seed trade.	L5	End Term Examination

- **Syllabus:**

Unit-1		Contact Hours: 2
Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production,		
Unit-2		Contact Hours: 3
Seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified		

seed production of important cereals, pulses, oilseeds, fodder and vegetables.		
Unit-3		Contact Hours: 3
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, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production		
Unit-4		Contact Hours: 3
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 and factors affecting seed longevity during storage. Measures for pest and disease control during storage		
Unit-5		Contact Hours: 3
Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.		
Practical	Suggested list of Exercises	
1	To study sampling methods for conducting various test.	
2	To conduct Physical Purity Test in the given seed lots.	
3	To conduct Germination Test in the given seed lots.	
4	To conduct Seed Vigour Test in the given seed lot.	
5	To study the methods of seed storage and their structures.	
6	To study seed treatment methods.	
7	To study various field activities like Planting Ratios, Detasseling, Rouging, and making crosses.	
8	To conduct field visit in a seed production plot of wheat/paddy, as a role play of Seed Inspector.	
9	To study various equipments and machinery used in Seed Processing.	
10	To determine moisture Percent in the given seed lot.	
11	Visit to Seed Processing Plant and study various machinery parts, storage and handling of seeds.	
12	To make Hybrid by means of emasculation and hybridization in brinjal/tomato/lady finger/mustard.	

- **Books:**

Textbooks: -

T1. Agrawal, R.L. Seed Technology by Oxford and IBH Pub, Co., New Delhi.

T2. Seed Production Manual NSC and Rockefeller Foundation.

Reference Books: -

R1. P.K. Agrawal and M. Dadlani. Techniques in Seed Science and Technology. Edited by South Asian Publishers, New Delhi

R2. Upadhyay, P K. Principles of Seed Technology. Kalyani Publishers.

R3. Phundan Singh. Principles of Seed Technology

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	0	2	0	0	1
CO2	3	2	2	0	0	2	0	0	0
CO3	2	3	0	2	2	0	3	0	0
CO4	2	2	3	0	3	2	2	1	0
CO5	1	2	3	2	2	1	1	1	2

Course: Agricultural Marketing Trade & Prices

Program	B.Sc. (Hons.) Agriculture	Semester	

Course Name	Agricultural Marketing Trade & Prices	L	T	P	C	Course Type
Course Code	AGR S212	1	0	1	2	SEC

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce fundamental concepts and principles of agricultural marketing, market structure, marketing mix, and market segmentation.
COb2	To develop understanding of demand, supply, producer's surplus, marketable and marketed surplus of agricultural commodities.
COb3	To familiarize students with product life cycle, pricing strategies, promotion methods, and marketing functions in agriculture.
COb4	To impart knowledge on marketing channels, market functionaries, integration, efficiency, costs, and price spread of farm products.
COb5	To create awareness about the role of government, cooperative marketing, risk management, agricultural price policy, and international trade in agricultural commodities.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain concepts, structure, classification, and characteristics of agricultural markets, and fundamentals of agricultural marketing.	L2	Mid Term
CO2	Analyze demand, supply, producer's surplus, marketable and marketed surplus, and factors affecting agricultural commodity markets.	L4	Mid Term
CO3	Describe product life cycle stages, competitive strategies, pricing approaches, promotion methods, and marketing functions in agriculture.	L2	Case Studies/ Project/ Assignment
CO4	Evaluate marketing channels, market functionaries, market integration, marketing efficiency, costs, margins, and price spread of farm commodities.	L5	Practical Examination
CO5	Explain the role of government institutions, cooperative marketing, risk management tools, agricultural price policy, and international trade frameworks including WTO and AoA.	L2, L4	End Term Examination

• **Syllabus:**

Unit-1		Contact Hours: 2
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.		
Unit-2		Contact Hours: 3
Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing.		
Unit-3		Contact Hours: 3
Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; 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 labeling (Agmark).		
Unit-4		Contact Hours: 3
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; 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.		
Unit-5		Contact Hours: 3
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; 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.		
Practical	Suggested list of Exercises	
1	To create an Advertisement of your own using inputs from old newspaper for a product of your choice. Incorporate all the features required to make your Ad. attractive, catchy and effective, using your creativity and theoretical knowledge on Advertising.	
2	To study various Packaging materials used in Agriculture marketing.	
3	To Study various marketing Intuitions involved in Agri-Marketing	
4	To Study the process of Minimum Support Price Declared by the GOI and values for Kharif/Rabi crops in the current year.	

5	To study various Marketing Channels involved in marketing of Food Grains, with estimation of margins and profits.
6	To study various Marketing Channels involved in marketing of Oilseeds, with estimation of margins and profits.
7	To study various Marketing Channels involved in marketing of Poultry, with estimation of margins and profits.
8	To study various Marketing Channels involved in marketing of Eggs, with estimation of margins and profits.
9	To study status of India in Export of Major Agricultural Commodities.
10	To study status of India in Import of Major Agricultural Commodities.
11	A Report on visit to local weekly market (Haat)
12	A report on Visit to Mandi Parishad (APMC)

• **Books:**

Textbooks: -

T1. Acharya, S.S. and Agrawal, N.L. Agricultural Marketing in India, Oxford and IBH Publishing Co, New Delhi

T2. Memoria, C.B. and Joshi, R.L., Principles and Practice of marketing in India, Kitab Mahal, Allahabad.

Reference Books: -

R1. Kohls, R. L. and N. Uhl. Joseph (1980). Marketing of Agricultural Products, Collier Macmillan, New York.

R2. Nagpal, Current, Issues in the World Trade Policies, International Book House, New Delhi.

Scheme of Evaluation:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9

→ Course Outcomes ↓									
CO1	3	2	0	0	0	0	0	0	1
CO2	2	3	0	2	0	0	0	0	0
CO3	3	2	2	0	0	0	0	1	0
CO4	2	3	2	2	1	0	0	0	0
CO5	2	2	0	2	1	1	3	1	2

Course: Crop Improvement I (Kharif crops)

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Crop Improvement I (Kharif crops)	L	T	P	C	Course Type
Course Code	AGR S303	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	To know about the centers of origin and taxonomical classification of various kharif crops in cereals crops, pulses crops, oilseeds crops, Cash crops, vegetable/condiment and horticultural crops.
COb2	To study the different breeding objectives of various kharif crops in cereals crops, pulses crops, oilseeds crops, Cash crops, vegetable/condiment and horticultural crops
COb3	To understand the various breeding methods in self-pollinated cross-pollinated and vegetative propagated crops
COb4	To distinguish between the quantitative and qualitative characters and learn their importance during selection to achieve higher seed yield and yield contributing traits.
COb5	To develop F1 seeds from the kharif crops

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Recall and identify the centres of origin, taxonomical classification, and basic characteristics of major Kharif crops.	L1
CO2	Explain the nutritional, economic, and agricultural importance of Kharif crops and describe qualitative and quantitative traits influencing crop improvement.	L2
CO3	Apply breeding objectives and methods for crop improvement in self-pollinated, cross-pollinated, and vegetatively propagated crops.	L3
CO4	Analyze and compare conventional, modern, in-situ and ex-situ conservation strategies and innovative breeding approaches for effective management of plant genetic resources.	L4
CO5	Design breeding programmes and develop hybrid (F ₁) seed production plans for Kharif crops to achieve desirable gene combinations and improved varieties.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 03
Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops		
Unit-2		Contact Hours: 05
Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetative propagated crops		

Unit-3		Contact Hours: 05
Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality. (Physical, chemical, nutritional)		
Unit-4		Contact Hours: 05
Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea, etc.		
Unit-5		Contact Hours: 05
Ideotype concept and climate resilient crop varieties for future..		
Practical	Suggested list of Exercises	
1	To learn the Floral biology and emasculation and hybridization of Rice	
2	To learn the Floral biology and emasculation and hybridization of Maize	
3	To learn the Floral biology and emasculation and hybridization of Soybean	
4	To learn the Floral biology and emasculation and hybridization of Groundnut	
5	To learn the Floral biology and emasculation and hybridization of Okra	
6	To learn the Floral biology and emasculation and hybridization of Brinjal	
7	To Study the field techniques of hybrid seed production in Kharif crops	
8	To learn the Layout of field experiments in plant breeding	
8	To know the Estimation of heterosis, inbreeding depression and heritability in Kharif crop	
10	To know the quality characters of different kharif crops	
11	To Visit a seed production plots	
12	To Visit AICRP plots of different kharif field crops	

4. Suggestive Readings:

Text Books:

T1. Crop Breeding and Biotechnology, Hari Har Ram, Kalyani Publishers, Ludhiana.

T2. Plant Breeding, Singh, B.D. Kalyani Publishers. New Delhi /Ludhiana

Reference Books:

R1. Essentials of Plant Breeding, By Singh, Phundan, Kalyani Publishers Ludhiana/ New Delhi

R2. Principles of Plant Breeding, Allard, R.W

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	2	0	0	1	0	0	1	0
CO2	2	3	2	1	1	1	0	1	0
CO3	2	3	1	2	3	2	1	0	1
CO4	1	3	2	1	2	3	2	1	1
CO5	1	2	2	3	3	2	2	1	3

Course: Crop Improvement II (Kharif crops)

Program	B.Sc. (Hons.) Agriculture	Semester				
Course Name	Crop Improvement II (Rabi crops)	L	T	P	C	Course Type
Course Code	AGR S307	1	0	1	2	SEC

Course Objectives:

1. To know about the centers of origin and taxonomical classification of various rabi crops in cereals crops, pulses crops, oilseeds crops, Cash crops, vegetable/condiment and horticultural crops
2. To study the different breeding objectives of various rabi crops in cereals crops, pulses crops, oilseeds crops, Cash crops, vegetable/condiment and horticultural crops
3. To understand the various breeding methods in self-pollinated cross-pollinated and vegetative propagated crops
4. To distinguish between the quantitative and qualitative characters and learn their importance during selection to achieve higher seed yield and yield contributing traits.
 5. To develop F1 seeds from the rabi crops

2. Course Outcomes:

At the end of the course the students will be able to-

S.No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
1.	Remember the centres of origin and classification of various rabi crops.	1	Mid Term Examination
2.	Understand the quantitative and qualitative traits in present day crop varieties of rabi crops the importance of rabi crops for nutritional and economic value	2	Mid Term Examination
3.	Apply the breeding objectives and methods in crop production of rabi crops	3	Quiz
4.	Analyze the conventional and modern innovative breeding approaches in breeding self-pollinated, cross- pollinated and vegetative propagated crops.	4	Assignment and Practical
5.	Evaluate the in-situ and ex-situ conservation strategies for the conservation of gene pool of plant genetic resources	5	Comprehensive Exam

3. Syllabus:

Unit 1:	Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops (Wheat, Rabi Sorghum, Oats, Barley, Chickpea, Lentil and Mustard)
Unit 2:	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross pollinated and vegetative propagated crops.
Unit 3:	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality. (Physical, chemical, nutritional)
Unit 4:	Hybrid seed production technology in Rabi Sorghum, Sunflower, Safflower, Castor, Mustard, Lentil etc.
Unit 5:	Ideotype concept and climate resilient crop varieties for future.
Practical	Suggested list of Exercises
1	To learn about the plant breeders kit and their uses
2	Hybrid seed production technology in Wheat
3	Hybrid seed production technology in Mustard
4	Hybrid seed production technology in Lentil
5	Hybrid seed production technology in Chickpea
6	The study of inheritance of quantitative traits in Rabi crops
7	To learn the different experimental designs in field-RBD design
8	To learn the different roles of plant genetic resources
9	To learn the stability models for a variety
10	To identify the climate resilient crop varieties for the future

□

4. BOOKS:

Text Books:

T1. Crop Improvement II (Rabi crops) Author-Prof. (Dr.) Rajendra Kumar Yadav, Dean, College of Agriculture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur and Dr. D.R. Singh, Vice Chancellor, Chandra Shekhar Azad University of Agriculture &

Technology, Kanpur, Kalyani Publishers, New Delhi 2020. The book is written as per ICAR 5th Dean's Committee Recommendation.

T2: Crop Breeding and Biotechnology Author-Hari Har Ram, Former Professor, Plant Breeding and Vegetable Breeding and Head, Vegetable Science, G.B. Pant University of Agriculture and Technology, Pantnagar, Second Revised edition 2019- Kalyani Publishers, New Delhi

References:

Book-Principles of Plant Breeding by Prof. (Dr.) B.D. Singh. Revised edition 2019- Kalyani Publishers, New Delhi

Book-Principles of Plant Breeding, Allard, R.W.

Practical Manual -Practical Manual in Plant breeding, Singh, R.K. and Singh B.D.Kalyani Publishers. New Delhi/ Ludhiana.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9

Outcomes →									
Course Outcomes ↓									
CO1	3	3	2	1	1	0	0	0	0
CO2	3	3	3	2	2	1	1	1	0
CO3	3	3	3	3	3	3	2	2	1
CO4	3	3	3	3	3	2	2	2	1
CO5	3	3	3	3	3	3	2	2	2

Course: Livestock and Poultry Management

Program	B.Sc. (Ag.) Agriculture	Semester				
Course Name	Livestock and Poultry Management	L	T	P	C	Course Type
Course Code	AGR S208	1	0	1	2	SEC

1. Course Objectives:

This course ensures that the students understand how:

COb1	Provide comprehensive education and research opportunities focused on the utilization and management of livestock and poultry in agricultural practices.
COb2	Expertise to identify the specific needs and challenges of utilizing livestock and poultry in farming, and to devise effective solutions utilizing modern technological advancements.

COb3	Foster a culture of ethical integrity, personal development, and entrepreneurial acumen among students, nurturing them to become future leaders in the sustainable management of livestock and poultry.
COb4	Empower students to conceive, plan and execute independent projects centered on the utilization and management of livestock and poultry manures in agricultural contexts.
COb5	Develop a competitive teaching-learning environment that prepares students for advanced studies and careers in the specialized field of livestock and poultry management within agriculture.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level
CO1	Understand the significance of animal production and management systems and recall the classification, breeds/types, and importance of cattle, buffalo, sheep, goat, and poultry.	L1
CO2	Explain the principles of housing, space requirements, and reproductive management practices for various livestock and poultry species under different production systems.	L2
CO3	Apply feeding and management practices by formulating balanced rations and implementing appropriate housing and care strategies based on age, weight, and stage of production.	L3
CO4	Analyze housing suitability under different climatic conditions and evaluate the impact of major livestock and poultry diseases to prioritize preventive and control measures, including vaccination schedules.	L4
CO5	Design comprehensive livestock and poultry management and awareness strategies, including health management plans and educational or extension programs for farmers and the general public.	L5 & L6

3. Syllabus:

Unit-1		Contact Hours: 7
Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, and space requirements for different species of livestock and poultry.		
Unit-2		Contact Hours: 9
Management of calves, growing heifers, and milch animals. Management of sheep, goats, and swine. Incubation, hatching, and brooding. Management of growers and layers.		
Unit-3		Contact Hours: 8
Digestion in livestock and poultry. Classification of feedstuffs Proximate principles of feed. Nutrients and their functions.		
Unit-4		Contact Hours: 9
Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.		
Unit-5		Contact Hours: 9
Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.		
Practical	Suggested list of Exercises	
1	To identify the external body parts of cattle, buffalo, sheep, goats, swine, and poultry.	
2	Handling and restraining livestock	
3	Identification methods of farm animals and poultry.	
4	Visit IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records	
5	Judging of cattle, buffalo, and poultry.	
6	Culling of livestock and poultry.	
7	Planning and layout of housing for different types of livestock	
8	Computation of rations for livestock	

9	Formulation of concentrate mixtures.
10	To study clean milk production, milking methods.
11	Hatchery operations, incubation, and hatching types of equipment.
12	Management of chicks, growers, and layers

4. Suggestive Readings:

Text Books:

T1. G.C. Banerjee. A Textbook of Animal Husbandry Oxford& IBH Publishing Co. Pvt. Ltd.

T2. Handbook of Animal Husbandry -ICAR, Krishi Anusandhan Bhawan, New Delhi.

References Book:

R1. N.S.R. Sastry and C.K. Thomas, Livestock Production and Management.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

7. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	3	1	0	1	1	1	1	0
CO2	2	3	2	1	2	2	1	1	1
CO3	3	3	2	2	3	3	2	1	2
CO4	3	3	3	2	3	3	2	1	2
CO5	3	3	3	3	3	3	3	1	3

Course: Human Values & Ethics

Program	B.Sc. (Hons.) Agriculture	Semester				I
Course Name	Introductory Biology	L	T	P	C	Course Type
Course Code	AGR R001	1	0	1	2	REM

Program	B.Sc. (Hons.) Agriculture	Semester				I
Course Name	Human Values & Ethics**	L	T	P	C	Course Type
Course Code	AGR N001	1	0	0	1	VAC

1. Course Objectives:

This course ensures that the students understand how:

COb1	To know values and ethics, goal and mission of Life.
COb2	To study about the vision of life including principles and philosophy, self exploration & self awareness.
COb3	To study about attachment and detachment, spirituality quotient and examination.
COb4	To study about self satisfaction, decision making, motivation, sensitivity, success & selfless service & case study of ethical lives, positive spirit, body, mind and soul.
COb5	To develop a competitive teaching-learning environment for enabling students for higher studies in the field of human values and ethics.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Course Outcomes	Bloom's Taxonomy level
CO1	Identify and explain the vision of life, basic principles, philosophy, and concepts of self-awareness, self-exploration, and self-satisfaction.	L1
CO2	Understand and develop personal values, ethics, positive attitudes, and sensitivity towards self and society.	L2

CO3	Apply ethical principles, motivation, and decision-making skills in daily life situations and analyze case studies of ethical and value-based living.	L3
CO4	Distinguish between attachment and detachment, evaluate personal goals, and assess spiritual and emotional well-being for balanced living.	L4
CO5	Design a purposeful life plan by setting goals, focusing on mission, practicing selfless service, and cultivating holistic development of body, mind, and soul.	L5

3. Syllabus:

Unit-1		Contact Hours: 02
Values and Ethics-An Introduction. Goal and Mission of Life.		
Unit-2		Contact Hours: 03
Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness.		
Unit-3		Contact Hours: 03
Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service.		
Unit-4		Contact Hours: 03
Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul.		
Unit-5		Contact Hours: 03
Attachment and Detachment. Spirituality Quotient. Examination.		

4. Suggestive Readings:

Text Books:

T1. J. Madhuri, Human values and Ethics, Kalyani Publishers, New Delhi.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	0	2	3	0	0	1	0	2	0
CO2	0	2	3	1	1	2	1	1	0
CO3	1	2	3	2	2	3	1	1	2
CO4	1	2	3	2	2	2	1	1	2
CO5	2	3	3	3	3	3	2	2	3

Course: Agripreneurship

Program	B.Sc. (Hons.) Agriculture				Semester				
Course Name	Agripreneurship				L	T	P	C	Course Type
Course Code	AGR V004				1	0	0	1	VAC

- **Course Objective:**

This course ensures that the students understand how:

COb1	To introduce the concept, characteristics, and process of entrepreneurship with special reference to agribusiness and rural enterprises.
COb2	To familiarize students with the impact of economic reforms, government policies, programs, and institutions supporting entrepreneurship development in agriculture.
COb3	To develop organizational, managerial, leadership, and problem-solving skills required for planning and managing agri-enterprises effectively.
COb4	To enable students to identify and analyze opportunities for agripreneurship and rural enterprise development for sustainable livelihood generation.
COb5	To equip students with skills in project formulation, planning, and report preparation for establishing viable agribusiness ventures.

- **Course Outcomes:**

Towards the end of the course, the students will be able to:

S. No.	Course Outcomes	Bloom's Taxonomy level	Evaluation component
CO1	Explain the concept of entrepreneurship, characteristics of entrepreneurs, and the entrepreneurial development process.	L2	Mid Term
CO2	Describe the impact of economic reforms, government policies, programs, and institutions supporting agribusiness and agri-enterprises.	L2	Mid Term
CO3	Apply organizational, managerial, leadership, and problem-solving skills in planning and managing agri-enterprises.	L3	Case Studies/ Project/ Assignment
CO4	Analyze opportunities for agripreneurship and rural enterprises for sustainable income generation.	L4	Practical Examination

CO5	Prepare a feasible agribusiness project plan and report using systematic project formulation techniques.	L6	End Term Examination
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• **Syllabus:**

Unit-1		Contact Hours: 2
Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Entrepreneurial Development Process		
Unit-2		Contact Hours: 3
Impact of economic reforms on Agribusiness/ Agri-enterprises, Busi Government policies and programs and institutions for entrepreneurship development.		
Unit-3		Contact Hours: 3
Developing organizational and Managerial skill; (Planning, organizing, staffing, controlling, supervising, problem solving, monitoring & evaluation), Business Leadership skills (communication, direction and motivation skills), Problem solving skill.		
Unit-4		Contact Hours: 3
Opportunities for agripreneurship and rural enterprise.		
Unit-5		Contact Hours: 3
Project Planning Formulation and report preparation.		

• **Books:**

Textbooks: -

T1.

Reference Books: -

R1.

• **Scheme of Evaluation:**

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2

Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination						
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

• **Course Outcomes – Program Outcomes (CO – PO) Mapping**

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	3	1	0	0	0	0	0	0	1
CO2	2	2	1	0	0	0	3	0	0
CO3	2	3	2	0	0	0	0	3	0
CO4	2	3	3	0	0	2	0	0	0
CO5	1	2	3	2	0	0	0	2	3

Course: Introductory Biology

i. Course Objectives:

This course ensures that the students understand how:

COb1	Describe the fundamental concepts of cell biology, genetics, evolution, and ecology, as well as their relevance to agricultural sciences.
COb2	Apply biological principles to analyze agricultural problems and propose scientifically sound solutions using modern technology.

COb3	Evaluate scientific literature related to biology and agriculture, identifying gaps in knowledge and areas for further research.
COb4	Design and conduct basic experiments in biology, including hypothesis formulation, data collection, and analysis, to address specific agricultural challenges.
COb5	Assess the ethical implications of biological research and agricultural practices, promoting integrity and personal growth, and demonstrating entrepreneurial skills in proposing innovative solutions.

ii. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level	Evaluation component
CO1	Recall the fundamental concepts of the living world, including diversity, characteristics of life, origin of life, evolution, and basic principles of eugenics.	L1	Mid Term
CO2	Explain the principles of binomial nomenclature, biological classification, cell structure, and processes of cell division.	L2	Mid Term
CO3	Describe and apply knowledge of flowering plant morphology, seed structure, germination processes, and conduct experiments to study seed germination and plant growth under different conditions..	L3	Case Studies/ Project/ Assignment
CO4	Classify and distinguish major plant families (Brassicaceae, Fabaceae, Poaceae) and analyze the roles of animals in agricultural systems.	L4	Practical Examination
CO5	Evaluate the significance of evolutionary theories and eugenics in agriculture and design classification keys or systematic tools for identification and categorization of plant species..	L5 & L6	End Term Examination

iii. Syllabus:

Unit-1	Contact Hours: 03
Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics	
Unit-2	Contact Hours: 03
Binomial nomenclature and classification Cell and cell division.	
Unit-3	Contact Hours: 03
Morphology of flowering plants. Seed and seed germination.	
Unit-4	Contact Hours: 03
Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae.	
Unit-5	Contact Hours: 02
Role of animals in agriculture.	
Practical	Suggested list of Exercises
1	To learn the Morphology of flowering plants
2	To learn the Morphology of plant root system
3	To learn the Morphology of stem
4	To learn the Morphology of leaf and their modifications
5	To learn the Morphology of Inflorescence- flower
6	To learn the Morphology of Fruits
7	To study the Plant Cell and Animal cell
8	To make section of the Different plant tissues, Parenchyma
9	To study the different stages of Mitosis Cell division in Onion root tips

10	To learn the different stages of Meiosis Cell division in Onion root tips
11	To make section and study the Internal structure of root
12	To make section and study the Internal structure of stem

iv. Suggestive Readings:

Text Books:

T1. A.C. Dutta, sixth edition Botany for degree students, Oxford University press.

T2. PK, Sehgal Introductory Biology, Kalyani Publishers. New Delhi

Reference books:

R1. T.C. Dutta A class book of botany, Oxford Publication.

v. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

vi. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
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Course Outcomes ↓									
CO1	1	3	1	0	0	1	0	2	0
CO2	1	3	1	0	1	1	1	2	0
CO3	2	3	1	1	3	2	1	1	2
CO4	3	3	2	1	3	3	2	1	2
CO5	2	3	2	2	2	3	2	2	3

Course: Elementary mathematics

Program	B.Sc. (Hons.) Agriculture	Semester	I
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Course Name	Elementary mathematics	L	T	P	C	Course Type
Course Code	AGR R002	2	0	0	2	REM

1. Course Objectives:

This course ensures that the students understand how:

COb1	Students can recall basic mathematical facts, such as multiplication tables, geometric shapes, and key terminology in mathematics.
COb2	Students demonstrate understanding by explaining concepts in their own words, interpreting mathematical problems, and identifying relationships between different mathematical ideas.
COb3	Students apply their knowledge to solve mathematical problems in familiar and unfamiliar contexts. They can use mathematical operations and strategies to solve word problems and practical scenarios.
COb4	Students analyze mathematical relationships, break down problems into smaller parts, and identify patterns or trends in numerical data.
COb5	Students assess the validity of mathematical solutions, justify their reasoning, and critique mathematical arguments or methods used by themselves and others.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level	Evaluation component
CO1	Recall and perform basic arithmetic operations including addition, subtraction, multiplication, and division.	L1	Mid Term
CO2	Explain fundamental mathematical concepts, principles, and procedures with clarity using examples and illustrations.	L2	Mid Term
CO3	Apply mathematical concepts, algorithms, mental math, and problem-solving strategies to solve routine and non-routine problems.	L3	Case Studies/ Project/ Assignment

CO4	Analyze and interpret data from charts, graphs, and tables, and evaluate the validity and accuracy of mathematical arguments and solutions.	L4	End Term Examination
CO5	Design mathematical models, diagrams, and representations and creatively apply mathematical concepts to solve novel real-life problems.	L5	End Term Examination

3. Syllabus:

Unit-1		Contact Hours: 15
Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line.		
Unit-2		Contact Hours: 05
Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral.		
Unit-3		Contact Hours: 05
Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.		
Unit-4		Contact Hours: 15
Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions.		
Unit-5	Group Behaviour and Dynamics	Contact Hours: 05
Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it). Integral Calculus : Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple		

problems based on it).Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation

4. Suggestive Readings:

Text Books:

- 1- R.D. Sharma. A text Book of mathematics in 11th Level
- 2- A Book of NCERT of 10th and 12th Level

Reference Books:

- 1- A Book of mathematics for 12th Level for Meerut Publications (Dr Bal Krishna)
- 2- A Book of mathematics for Diploma in engineering Louthra

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	40			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5
Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	1	3	0	0	1	1	0	1	0
CO2	1	3	1	0	1	1	0	2	0

CO3	2	3	1	1	2	3	1	1	2
CO4	2	3	2	2	2	3	1	1	2
CO5	3	3	2	3	3	3	2	1	3

Course: Agricultural Heritage

Program	B.Sc. (Hons.) Agriculture	Semester				I
Course Name	Agricultural Heritage	L	T	P	C	Course Type
Course Code	AGR R003	1	0	0	1	REM

1. Course Objectives:

This course ensures that the students understand how:

COb1	Know about the ancient agriculture practices.
COb2	Understand relevance of heritage to present day agriculture.
COb3	Differentiate between past and present day agriculture.
COb4	Able to evaluate the significance of agriculture and agricultural resources available in India.
COb5	Design a module for the production and protection of crop in an ethical and sustainable manner.

2. Course Outcomes:

Towards the end of the course, the students will be able to:

CO	Outcome	BT Level	Evaluation component
CO1	Describe the evolution, history, and significance of Indian agriculture from the Vedic period to modern agriculture, and recognize the usefulness of agricultural resources in India.	L1	Surprise quiz
CO2	Correlate traditional agricultural heritage and indigenous knowledge systems with present-day agricultural practices and development.	L2	Case Studies/ Project/ Assignment

CO3	Apply modern agricultural practices and appropriate crop protection methods in an ethical manner to improve qualitative and quantitative crop production.	L3	Mid Term
CO4	Analyze crop production problems using indigenous technical knowledge and evaluate the current agricultural setup and challenges in India.	L4	Practical Examination & End term Examination
CO5	Evaluate the significance and future vision of Indian agriculture and propose sustainable and socially responsible strategies for agricultural development.	L5 & L6	Practical Examination & End term Examination

3. Syllabus:

Unit-1		Contact Hours: 03
History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions (with special reference to Uttarakhand); Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.		
Unit-2		Contact Hours: 03
Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.		
Unit-3		Contact Hours: 03
Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme (with special reference to uttarakhand).		

Unit-4		Contact Hours: 03
Intensive Agricultural District Programme, Special group – Area Specific Programme (with special reference to uttarakhand), Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives,		
Unit-5		Contact Hours: 02
Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes (especially in context of Uttarakhand).		

4. Suggestive Readings:

Text Books:

T1. Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ. Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.

T2. Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives.

Reference books:

R1. Mittal Publ. Singh K.. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

5. Assessment Scheme:

Component	Adopted for this Course	Duration	Weightage	Date & Time	Venue	Levels
Mid Term Examination	<input checked="" type="checkbox"/>	1hr	20			Levels 1 to 2
Case Studies/ Assignment	<input checked="" type="checkbox"/>		05			Levels 1 to 5

Surprize Quiz	<input checked="" type="checkbox"/>	10 min	05			Level 1
End semester Practical Examination	<input checked="" type="checkbox"/>	1 hr	20			Levels 3 to 6
End semester Examination	<input checked="" type="checkbox"/>	3 hr	50			Levels 1 to 5

6. Course Outcomes – Program Outcomes (CO – PO) Mapping

Program Outcomes →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course Outcomes ↓									
CO1	2	3	1	0	1	1	1	2	0
CO2	2	3	2	1	2	2	1	1	1
CO3	3	3	3	2	3	3	2	1	2
CO4	3	3	2	2	3	3	2	1	3
CO5	3	3	3	3	3	3	3	2	3