THE ASSAM
ROYAL GLOBAL UNIVERSITY
GUWAHATI

ROYAL SCHOOL OF LIFE SCIENCES

(RSLSC)

AGRICULTURE

COURSE STRUCTURE & SYLLABUS

FOR

B.SC. IN AGRICULTURE

(4 YEARS)

W.E.F

AY - 2025- 2026

S. No	Course Title	Credit Hours (T+P)	Total credit hours	Online/ MOOCS credit hours
Semester I				
Deeksharambh (non-gradial course of 15 days duration)		0+2 (Non-Gradial)	02	10 To be taken over the entire durtion from Semesters I-VIII
1.1. Core courses (Major+Minor) to be speficied				
1.1.1	Fundamentals of Agronomy	02+01=03		
1.1.2	Fundamentals of Horticulture	02+01=03		
1.1.3	Fundamentals of Soil Science	02+01=03		
1.1.4.	Principles of Organic Farming (Suggested for Minor)	02+01=03		
1. 2. -Multidisciplinary courses (students may choose any one of the courses) it has to be farming based livelihood systems				
1.2.1	Agroecology & Indigenous Knowledge	03+00=03		
1.2.2	Agribusiness and Rural Development		22	
1.2.3	Urban Farming And landscape design			
1.3. Ability enhancement courses (students may choose any one from 1.3.1 and 1.3.2) 1.3.3 is mandatory				
1.3.1	Personality development	02+00=02		
1.3.2	Communication Skills in English-I	02+00=02		
1.3.3	NSS/NCC	01+00=01		
1.4. Skill enhancement courses				
1.4.1	Basics of Startup and Entrepreneurship	04+00=04		
Total credits		22	22	
Semester II				
2.1. Core courses (Major+Minor) to be speficied				
2.1.1	Fundamentals of Entomology	03+01=04		
2.1.2	Introductory Animal Husbandry	02+01=03		
2.1.3	Farming based livelihood systems (Suggested Minor)	02+01=03		
2.2. Interdisciplinary courses (students may choose any one of the courses) (It has to be Entrepreneurship Development and Business Management)				
2.2.1	Mushroom Cultivation: Spore to Startup	03+00=03		
2.2.2	Production Technology for Vegetables and Spices	03+00=03		
2.2.3	Basics of agricultural marketing and Trade	03+00=03	22	
2.3. Value added courses (students may choose any one of the courses) (To be based on Environmental Studies and Disaster Management)				
2.3.1	Environmental Studies and Sustainable Development	01+02=03		
2.3.2	Disaster Management and Adpatation Strategies	01+02=03		
2.3.3	Ecological Restoration & Conservation	01+02=03		
2.4. Ability enhancement courses (students may choose any one from 2.4.1 and 2.4.2 courses) (Personality Development)				
2.4.1	Soft Skill and Personal Growth	02+00=02		
2,4,2	Stress Management & Positive Thinking	02+00=02		
2.4.3	NCC/NSS (Mandatory)	01+00=01		
2.5. Skill enhancement courses				
2.5.1	Floriculture	00+04=04		
Total credits		22		
2.6.1	Post semester Internship of 10 weeks (UG Certification)	10		

Semester III				
3.1 Advanced level Core courses (Major & Minor to be specified)			20	
3.1.1	Plant Pathology and crop diseases	03+01=04		
3.1.2	Principles of crop Genetics	03+01=04		
3.1.3	Agricultural microbiology and phytoremediation (Minor)	03+01=04		
3.1.4	Crop Production technology-1 (Kharif crops)	03+01=04		
3.2 Ability enhancement courses (students may choose any one of the courses)(Physical Education, First Aid and Yoga Practices)				
3.2.1	Lifestyle Management through Physical Education	01+01=02		
3.2.2	Yoga for Mental Health & Stress Management	02+00=02		
3.3 Skill enhancement courses (students may choose any one of the courses)				
3.3.1	3D graphics	01+01=02		
3.3.2	Bee culture	01+01=02		
Total credits		20		
Semester IV				
4.1. Advanced level core courses (Major+Minor to be specified)			20	
4.1.1	Plant breeding-I	02+01=03		
4,1,2	Crop physiology and biochemistry-I	02+01=03		
4.1.3	Crop Production technology-II (Rabi crops)	02+01=03		
4.1.4	Principles of Agricultural Economics and Farm Management (Minor)	02+01=03		
4.2 Interdisciplinary courses (students may choose any one of the courses) (To be based Agriculture Marketing & Trade)				
4.2.1	Agri-Finance, Marketing Risk and Insurance	02+01=03		
4.2.2	Digital Marketing in Agriculture	02+01=03		
4.2.3	Agri based Value addition Management	02+01=03		
4.3 Value added courses (students may choose any one of the courses) (To be based Agriculture Informatics)				
4.3.1	Agri-informatics	02+01=03		
4.3.2	Data management in Agriculture	02+01=03		
4.3.3	Big Data and AI in Agriculture	02+01=03		
4,4 Skill Development courses (students may choose any one of the courses)				
4.4.1	Vermicomposting	00+02=02		
	Cloud computing	00+02=02		
Total credits		20		
4.5.	Post semester internship (For UG Diploma)	10		
Semester V				
5.1	Core courses (Major +Minor to be specifie)		21	
5.1.1	Agricultural Economics	03+00=03		
5.1.2	Crop physiology and Biochemistry-II	02+01=03		
5.1.3	Plant Breeding- II	02+01=03		
5.1.4	Agri Biotechnology	02+01=03		
5.1.5	Pest management in Crops and Stored Grains	02+01=03		
5.1.6	Diseases of Field & Horticultural Crops & their Management	02+01=03		
5.1.7	Fundamentals of Extension Education (Suggested Minor)	03+00=03		
Total credits		21		
Semester VI				
6.1	Core courses (Major +Minor to be specified)		21	

6.1.1	Principles of Food Science & Nutrition	02+01=03		
6.1.2	Dryland agriculture and Rainfed agriculture	02+01=03		
6.1.3	Basic and Applied Statistics	03+00-03		
6.1.4	Seed Science & Technology	03+00=03		
6.1.5	Geo-informatics and Nanotechnology in agriculture	02+01=03		
6.1.6	Intellectual Property Rights (Suggested Minor)	02+00=02		
6.1.7	Watershed management	02+00=02		
6.1.8	Precision Farming & Sustainable Agriculture	02+00=02		
Total credits		21		
Semester VII				
7.1	Core courses (Major+Minor to be specified)		21	
7.1.1	Agroforestry	02+01=03		
7.1.2	Renewable energy in Agriculture and Allied Sectors	02+01=03		
7.1.3	Weed management	02+01=03		
7.1.4	Soil Fertility Management	02+01=03		
7.1.5	Post-harvest technology of horticulture crops	02+01=03		
7.1.6	Fish Processing and Value Addition	02+01=03		
7.7.7	Fundamentals of Seed Science & Technology (Suggested Minor)	02+01=03		
Total credits		21		
VIII Semester				
8.1	Elective Courses (The Department may offer any five papers in a given year)	03+01=04	20	**As per the 6th Deans committee draft the entire 8th semester is for Internship/ Project/ Student READY of 20 Credits**
8.1.1	Agriculture Waste Management	03+01=04		
8.1.2	Commercial Beekeeping	03+01=04		
8.1.3	Commercial Horticulture	03+01=04		
8.1.4	Seed Production and Technology	03+01=04		
8.1.5	Commercial Sericulture	03+01=04		
8.1.6	Production Technology for Bioagents and Biofertilizer	03+01=04		
8.1.7	Nanobiotechnology	03+01=04		
8.1.8	Food processing	03+01=04		
Total credits		20		
TOTAL CREDITS FOR THE ENTIRE COURSE: 167+20 (Internship)+2 (non-gradial)				

B. Sc Course in Agriculture: Semester-I

MAJOR SUBJECT: FUNDAMENTALS OF AGRONOMY

Subject Code: | Course Level: 100
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective:

To introduce the basic principles of agronomy and its relevance in crop production and sustainable agriculture.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the basic concepts and scope of agronomy.	**BT - 2**
CO2	Identify and classify crops and agroclimatic zones.	**BT - 3**
CO3	Apply principles of crop production and resource management.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Fundamentals of Agronomy** Agronomy: Definition, Scope, and Importance; Relationship of Agronomy with Other Sciences; Classification of Crops; Agroclimatic Zones of North-East India; Plant Ideotypes; Concept of Yield and Yield Components; Adaptation and Distribution of Crops.	12
II	**Soil and Seed Bed Preparation** Tillage and Tilth; Seeds and Sowing; Crop Density and Geometry; Intercultural Operations; Crop Rotation and Its Principles; Cropping Systems (Mono, Mixed, Inter, Relay); Preparation and Layout of Experimental Plots; Sowing Time and Methods; Soil Structure and its Management.	12
III	**Crop Nutrition and Resource Management** Crop Nutrition and Essential Nutrients; Manures and Fertilizers; Nutrient Use Efficiency; Soil Fertility and Productivity; Water Management (Basic Concepts); Integrated Nutrient Management (INM);	12
IV	**Weed, Harvest, and Crop Management** Weeds: Characteristics and Classification; Crop–Weed Competition; Weed Management Principles; Herbicides: Classification, Selectivity, Resistance; Allelopathy; Crop Management in Problematic Areas; Harvesting and Threshing of Crops; Principles of Storage.	12

Practicals:

1. Identification and handling of tillage implements;
2. Determination of soil moisture and tilth condition;

3. Preparation of seedbed and line sowing in plots;
4. Field demonstration of sowing techniques (broadcasting, drilling, transplanting);
5. Layout of crop rotation and cropping system plots;
6. Measurement of plant spacing and plant population.

Textbooks:

- Yellamanda Reddy, T. & Sankara Reddy, G.H. (2020). Principles of Agronomy. Kalyani Publishers.
- Palaniappan, S.P. (2008). Cropping Systems in the Tropics: Principles and Management. Wiley Eastern.

Reference Books:

- ICAR (2021). Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
- Panda, S.C. (2016). Agronomy. Agrobios (India), Jodhpur.

MAJOR SUBJECT: FUNDAMENTALS OF HORTICULTURE

Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective: To provide an overview of horticulture, its scope, practices, and importance in nutritional and livelihood security.

Course Outcome:

CO1	Understand horticultural scope, branches, and classification.	**BT - 2**
CO2	Apply propagation and training practices.	**BT - 3**
CO3	Analyze climate and pest management in horticulture.	**BT - 4**

Detailed Syllabus:

Module	**Course Content**	**Lecture Hours**
I	Definition and importance of horticulture; Branches of horticulture; Scope and importance in India; Area and production data; Export/import; Horticultural zones; Classification of crops	12
II	Planting systems and density; Nursery management; Propagation – sexual/asexual; Soil practices; Organic/inorganic nutrients; Training and pruning; Growth regulators.	12
III	Climatic requirements; Irrigation methods; Water use efficiency; Weed, pest, and disease management; Protected cultivation.	12
IV	Harvest indices; Post-harvest handling; Packaging, storage, and transport; Marketing and export potential; Value addition and food security	12

Practicals:

1. Identification of horticultural crops and classification; Preparation of nursery beds and raising of seedlings; Practice of propagation methods – cutting, layering, budding, grafting;
2. Soil sampling and testing for horticultural crops; Preparation and application of manures and fertilizers;
3. Irrigation scheduling and methods demonstration; Identification of common pests and diseases of horticultural crops;
4. Post-harvest handling – sorting, grading, and packaging;
5. Visit to horticultural research stations/nurseries/markets; Preparation of herbarium of horticultural crops.

Textbooks:

- Kumar, N. (2019). *Introduction to Horticulture*.
- Prasad, S. & Kumar, U. (2020). *Principles of Horticulture*.

Reference Books:

- Chadha, K.L. (2021). *Handbook of Horticulture*.
- Edmond, J.B. et al. (2017). *Fundamentals of Horticulture***.**

MINOR SUBJECT: PRINCIPLES OF ORGANIC FARMING

Subject Code: | Course Level: 100
L-T-P-C: 3-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective: To impart knowledge on the principles, practices, and relevance of organic farming for sustainable agriculture.

Course Outcome:

CO1	Understand the philosophy and global development of organic farming.	**BT - 2**
CO2	Apply principles of nutrient and pest management in organic systems.	**BT - 3**
CO3	Analyze ecological tools for crop protection.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Soil Science** Definition and scope of soil science; Soil as a natural body and medium for plant growth; Components of soil; Soil genesis – weathering of rocks and minerals; Factors and processes of soil formation; Soil profile and its horizons; Classification of rocks and minerals.	12
II	**Physical and Chemical Properties of Soil** Soil texture and structure; Bulk density, particle density, and porosity; Soil color and temperature; Soil water – types, retention, movement, and availability; Soil air and its significance; Soil reaction (pH), electrical conductivity (EC), and cation exchange capacity (CEC); Soil colloids and their properties; Soil organic matter and its decomposition.	12

III	**Soil Fertility and Nutrient Management** Essential plant nutrients – criteria of essentiality; Functions and deficiency symptoms of essential nutrients; Sources and forms of nutrients in soil; Soil fertility vs. soil productivity; Fertilizer types and their application methods; Integrated nutrient management (INM); Soil amendments; Role of microorganisms in nutrient cycling; Biological nitrogen fixation.	12
IV	**Soil and Environmental Interaction** Problem soils – saline, alkaline, acidic, and waterlogged soils; Reclamation and management practices; Soil erosion – types, causes, and control; Soil conservation methods; Soil pollution – causes, effects, and management; Soil health and sustainable soil management practices.	12

Practicals:

1. Study of soil profile and collection of soil samples;
2. Determination of soil texture by feel and mechanical analysis;
3. Measurement of soil pH, EC, and organic carbon;Estimation of soil moisture content; Study of soil color using Munsell color chart; Determination of bulk density and porosity; Analysis of soil nutrients (N, P, K);
4. Preparation and application of compost and green manure;
5. Field visit to soil conservation sites or research stations.

Textbooks:

- Palaniappan, S.P. & Annadurai, K. (2008). *Organic Farming: Theory and Practice*.
- Ramesh, P. et al. (2010). *Organic Farming: Current Status and Future Prospects*.

Reference Books:

- IFOAM (2022). *Organic Agriculture Worldwide*.
- Lampkin, N. (2002). *Organic Farming*.

MINOR SUBJECT: PRINCIPLES OF ORGANIC FARMING

Subject Code: | Course Level: 100

L-T-P-C: 3-0-1-3 | Credit Units: 03

SCHEME OF EVALUATION: T+P

Course Objective: To impart knowledge on the principles, practices, and relevance of organic farming for sustainable agriculture.

Course Outcome:

CO1	Understand the philosophy and global development of organic farming.	**BT - 2**
CO2	Apply principles of nutrient and pest management in organic systems.	**BT - 3**
CO3	Analyze ecological tools for crop protection.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Fundamentals and Philosophy of Organic Farming** Definition, concept, and relevance of organic farming; Historical development and global status of organic farming; Principles and philosophy of organic agriculture;	12

	Differences between organic and conventional farming; Importance of organic farming for sustainable agriculture; Role of organic farming in soil health and biodiversity conservation.	
II	**Organic Inputs and Nutrient Management** Organic manures: farmyard manure, compost, green manure, vermicompost, and bio-digested slurry; Organic nutrient sources and their characteristics; Integrated nutrient management in organic systems; Use of biofertilizers – types and application; Role of legumes in soil fertility enhancement; Crop residue management; Organic nutrient cycling and soil fertility maintenance.	12
III	**Pest, Disease, and Weed Management in Organic Systems** Principles of pest and disease management in organic farming; Biological control agents and their use; Use of botanicals and plant-based pesticides; Integrated weed management; Crop rotation, intercropping, and trap cropping as ecological tools.	12
IV	**Certification, Marketing, and Future Prospects** Organic certification – national and international standards (NPOP, IFOAM); Certification agencies and procedures; Labelling and packaging of organic products; Marketing channels for organic produce; Challenges and prospects of organic farming in India; Policy support and incentives for organic agriculture; Role of organic farming in climate change mitigation and sustainable development.	12

Practicals:

1. Preparation of compost and vermicompost;
2. Demonstration of green manuring practices;
3. Field visits to organic farms and certification bodies;
4. Identification and application of botanicals and biopesticides;
5. Weed and pest monitoring in organic fields;
6. Record keeping for organic certification;
7. Preparation of organic product labels and understanding certification logos**.**

Textbooks:

- Palaniappan, S.P. & Annadurai, K. (2008). *Organic Farming: Theory and Practice*.
- Ramesh, P. et al. (2010). *Organic Farming: Current Status and Future Prospects*.

Reference Books:

- IFOAM (2022). *Organic Agriculture Worldwide*.
- Lampkin, N. (2002). *Organic Farming*.

Multidisciplinary course: **Agribusiness and Rural Development**
Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective: To provide insights into agribusiness systems, rural development strategies, and entrepreneurship opportunities.

Course Outcome:

CO1	**Understand agribusiness concepts and components.**	**BT - 2**

CO2	**Apply management and marketing principles.**	**BT - 3**
CO3	**Analyze rural development policies and institutions.**	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Fundamentals of Agribusiness** Definition, concept, and components of agribusiness; Importance of agribusiness in Indian economy; Agribusiness system and supply chain; Role of agriculture in business and industrial development; Structure and types of agribusiness enterprises; Emerging trends in agribusiness management.	12
II	**Module II: Agribusiness Management and Marketing** Principles of management applicable to agribusiness; Planning, organizing, staffing, directing, and controlling; Agri-marketing – concepts, functions, and channels; Pricing strategies and market intelligence; Role of institutions in agri-marketing (NAFED, FCI, APMC); Agri-export and international trade; Agribusiness project planning and appraisal.	12
III	**Module III: Rural Development and Institutions** Definition and scope of rural development; Rural development programmes and policies in India (IRDP, MGNREGA, NRLM); Role of Panchayati Raj Institutions and Self-Help Groups (SHGs); Rural credit – sources, institutions, and cooperatives; Role of NABARD, MFIs, and banks in rural finance; Women in rural development.	12
IV	**Module IV: Entrepreneurship and Innovations in Agribusiness** Concept of entrepreneurship and agri-entrepreneurship; Rural entrepreneurship – significance and constraints; Start-ups and innovations in agriculture; Agri-incubation and skill development; ICTs and e-governance in rural areas; Public-Private Partnerships (PPP) in agribusiness; Role of NGOs and corporate social responsibility (CSR) in rural development.	12

Textbooks:

- Singh, S. (2019). *Agribusiness Management*.
- Acharya, S.S. & Agarwal, N.L. (2021). *Agricultural Marketing in India*.

Reference Books:

- Dhawan, V. (2012). *Agribusiness and Rural Development*.
- NABARD Reports (Latest editions).

MAJOR SUBJECT: **URBAN FARMING AND LANDSCAPE DESIGN**
Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective:

To introduce the concepts and practices of urban farming and landscape design for food security and environmental sustainability.

Learning Outcomes (Mapped to Bloom's Taxonomy):

CO1	Understand the types, scope, and benefits of urban farming	**BT - 2**
CO2	Apply principles of soil, water, and crop management in urban environments.	**BT - 3**
CO3	Analyze landscape design elements and their urban application.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	Urban farming: definition, importance, global trends; Types: rooftop, vertical, backyard, community gardens, hydroponics; Urban farming and food security, waste management, climate resilience; Challenges and opportunities.	12
II	Urban soils: challenges and fertility management; Soil remediation; Water sources and irrigation (drip, sprinkler, recycled); Crop planning; Organic inputs and IPM in urban farming.	12
III	Basics of landscape design: line, form, color, texture, scale; Types of landscapes: formal, informal, recreational; Plant selection for urban landscaping; Public and private space design.	12
IV	Green infrastructure: green roofs, vertical gardens, bioswales, urban forests; Urban biodiversity, microclimate regulation; Smart city planning; Policies, governance, and planning of urban agriculture	12

Total Lecture Hours: 60

CREDIT DISTRIBUTION

LECTURE/TUTORIAL	PRACTICALS	EXPERIENTIAL LEARNING
60	00	30 Home Assignments - Seminars - Viva-voce - Field Visits

Textbooks:

- Mukherjee, A. (2020). *Urban Agriculture and Landscape Planning*.
- Tamang, A. (2021). *Urban Farming Techniques*.

Reference Books:

- FAO (2019). *Urban Agriculture: City Case Studies*.
- WHO (2020). *Urban Green Spaces and Health*.

MAJOR SUBJECT: **URBAN FARMING AND LANDSCAPE DESIGN**
Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective:

To introduce the concepts and practices of urban farming and landscape design for food security and environmental sustainability.

Learning Outcomes:

CO1	Understand concepts, types, and importance of entrepreneurship.	**BT - 2**
CO2	Apply idea generation techniques and identify viable opportunities.	**BT - 3**
CO3	Analyze business planning and legal aspects.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	Introduction to entrepreneurship; Economic significance; Entrepreneur types and traits; Ecosystem and institutions: MSME, SIDBI, Startup India; Competencies of successful entrepreneurs	12
II	Startup ecosystem; Startups vs traditional businesses; Idea generation and opportunity identification; Feasibility and risk analysis; Business model canvas; Innovation and creativity.	12
III	Venture creation steps; Business plan and project report preparation; Market, financial, and operational planning; Legal structure, IPR, tax; Funding: bootstrapping, angel investors, VC, crowdfunding.	12
IV	Scaling and sustaining startups; Role of tech and digital tools; Social entrepreneurship; Challenges: financial, managerial, operational; Case studies of successful entrepreneurs.	12

Total Lecture Hours: 60
Textbooks:

- Desai, V. (2019). *Dynamics of Entrepreneurial Development and Management*.
- Hisrich, R.D. et al. (2018). *Entrepreneurship*.

Reference Books:

- Ministry of Skill Development and Entrepreneurship (2022). *Schemes and Guidelines*.
- NASSCOM (2021). *Indian Startup Ecosystem Report*.

B. Sc Course in Agriculture: Semester-II

FUNDAMENTALS OF ENTOMOLOGY
Subject Code: | Course Level: 100 L-T-P-C: 3-0-1-4 | Credit Units: 04 SCHEME OF EVALUATION: Theory+ Practical (T+P)

Course Objective:

To introduce the basic principles of entology to understand the its impact and mitigation strategy in crop production and sustainable agriculture.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the diversity of insects in relation to their structure, function, and classification.	**BT - 2**
CO2	Understand the **insect morphology, anatomy, and physiology**, and how these contribute to their ecological success.	**BT - 3**
CO3	**Familiarize with the ecological roles and behaviors of insects,** including their interactions with plants, animals, and human activities.	**BT - 4**
CO4	**Develop practical skills** in insect collection, preservation, and identification using standard entomological techniques	**BT- 3**

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**
I	**Insect morphology and classification** History and scope of entomology. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, wing venation, modifications and wing coupling apparatus. Structure of male and female genital organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Importance of insects in agriculture, medicine, and environment.	12
II	**Insect Anatomy and Physiology**	12

	Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive systems in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes and chemoreceptors.	
III	**Systematics** Taxonomy -importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present-day insects with special emphasis to orders and families of Agricultural importance.	12
IV	**Insect Ecology and Behavior** Insect habitats and adaptations, Trophic interactions and ecological roles of insects, Insect-plant relationships (pollinators, herbivores), Intraspecific and interspecific interactions (competition, predation, parasitism), Behavior: Foraging, mating, communication (pheromones, sound), Seasonal cycles and diapause	12

Practicals

1. Study of External features of Grasshopper/Blister beetle.
2. Study of types of insect antennae, mouthparts and legs.
3. To study the wing venation, types of wings and wing coupling apparatus.
4. Study of types of insect larvae and pupae.
5. Dissection of digestive system in insects (Grasshopper).
6. Dissection of male and female reproductive systems in insects (Grasshopper).

INTRODUCTORY ANIMAL HUSBANDRY

Subject Code: | Course Level: 100
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory+ Practical (T+P)

Course Objective: The course is designed to-

- Provide scientific knowledge of livestock breeds, nutrition, housing, and reproduction.
- Develop understanding of livestock health management, disease prevention, and welfare.

- Familiarize students with management practices for dairy, poultry, and other livestock enterprises.
- Impart practical skills in animal care, breeding, record maintenance, and farm operations.

Course Outcome:

CO1	Identify and describe major breeds of cattle, buffalo, sheep, goat, pig, and poultry.	**BT – 1**
CO2	Explain principles and practices of breeding, feeding, housing, and management of livestock.	**BT - 2**
CO3	Apply knowledge of animal breeding, reproduction, and genetics to improve livestock performance.	**BT – 3/4**

Detailed Syllabus:

Module	**Course Content**	**Lecture Hours**
I	**General Aspects of Animal Husbandry:** Importance of livestock in Agriculture and Economy. Dairying under specialized and mixed farming. Livestock and milk production statistics.	12
II	**Dairy Cattle and Buffaloes Management** Cattle and buffalo Breeds, Breeding methods & systems, Care and Management of pregnant and milch cow, Raising of calves, Management of heifers and bulls, Maintenance of livestock records, Milking methods and principles, Clean milk production, Feeds and feeding, Conservation of fodder, Housing for dairy animals.	12
III	**Pig, Sheep and Goat Management** Importance, Importants of selection of breeds, General aspects of breeding, Raising of piglets up to age of slaughter, Care of sow and boar. Important. Raising of kids and lambs, Breeding and Feeding of goats and sheep.	12
IV	**HEALTH MANAGEMENT:** Common animal diseases of cattle, buffalo, goat, sheep and swine viz. Anthrax, BQ, HS, Brucellosis, Mastitis, Milk fever, Bloat, Swine fever and Enterotoxemia, Vaccination schedule.	12

Practical

1. To study of external body parts.
2. Study of phenotypic and physiological difference between cow and buffaloes.

3. Estimation of cost of milk production.
4. To understand the problems on computation of ration, casting and throwing, Grooming
5. Recording temperature, pulse rate and respiration rate of animals.

FARMING-BASED LIVELIHOOD SYSTEMS
Subject Code: | Course Level: 100
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory+ Practical (T+P)

Course Objective: This course aims to:

- Introduce the concept of farming-based livelihood systems in rural and agrarian economies.
- Explore the components of diversified farming systems and their role in sustainable income generation.
- Analyze integrated approaches combining crop, livestock, fisheries, agroforestry, and off-farm enterprises.
- Develop knowledge of planning, evaluating, and improving farming systems for enhanced livelihood security.
- Enable practical understanding of case studies, livelihood mapping, and system analysis.

Course Outcome:

CO1	To describe the concepts and types of farming-based livelihood systems.	**BT - 1**
CO2	To identify and explain the components of diversified farming systems including crop-livestock integration.	**BT - 2**
CO3	To apply basic tools to assess the socio-economic potential of different farming systems.	**BT - 3**
CO4	Analyze the sustainability, efficiency, and viability of different farming-based livelihood strategies.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Basic concepts of Farming and Livelihood Systems** Definition and concept of livelihoods and livelihood security, Farming systems approach: principles and objectives, Classification of farming systems (subsistence, commercial, organic, etc.), Role of agriculture in rural livelihoods and rural economy	12
II	**Components of Farming Systems**	12

	Crop-based systems: cereal, horticultural, cash crops, Livestock-based systems: dairy, small ruminants, backyard poultry, Fishery, beekeeping, sericulture, mushroom cultivation, Agroforestry and agri-horti-silvi systems, Nutrient cycling and resource recycling in integrated systems.	
III	**Livelihood Diversification and Integration** Scope of livelihood diversification, Integrated Farming Systems (IFS): models and planning, Role of women, SHGs, and cooperatives in rural livelihoods, Risk minimization through diversification, Climate-resilient livelihood strategies	12
IV	**Planning, Evaluation, and Policy Aspects** Tools for assessment of farming systems, Role of extension and rural institutions in livelihood promotion, Government schemes, subsidies, and programs.	12

Practical:

1. Visit to integrated farms.
2. Preparation of resource flow diagram for mixed farms
3. Case studies on crop-livestock integrated systems
4. Case studies on gender roles in farm-based livelihoods
5. Conduct a PRA in a local village to assess farming practices.

MUSHROOM CULTIVATION: SPORE TO STARTUP

Subject Code: | Course Level: 100

L-T-P-C: 3-0-0-3 | Credit Units: 03

SCHEME OF EVALUATION: Theory (T)

Course Objective: **D**evelop a scientific understanding of mushroom biology, cultivation techniques, and commercial production, integrating strain selection, substrate preparation, pest management, and value-added processing for sustainable entrepreneurship.

Course Outcome:

CO1	**Explain** the nutritional requirements, environmental conditions, and substrates essential for successful mushroom cultivation.	**BT - 2**
CO2	**Apply** appropriate cultivation techniques, including spawn preparation, substrate sterilization, and crop management for major mushroom species.	**BT - 3**
CO3	**Analyze** the cost-benefit structure, marketing strategies, and business opportunities in mushroom entrepreneurship.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours

I	**Fundamentals of Mushroom Biology and Cultivation** Introduction to fungal biology and classification of edible and medicinal mushrooms. Life cycle, growth requirements, and physiological needs of mushrooms. Cultivation techniques of major edible mushroom species (subject to availability). Substrate selection and preparation: Agricultural waste utilization for mushroom production. Spawn production techniques: Mother culture preparation, media sterilization, and inoculation methods.	12
II	**Pest Management, Post-Harvest Processing, and Commercial Applications** Disease management and pest control strategies in mushroom farms. Nutritional and medicinal properties of mushrooms: Bioactive compounds, antioxidant properties, and nutraceutical applications. Post-harvest handling: Drying, packaging, storage, and value-added processing (mushroom powders, extracts, functional foods). Economic feasibility and entrepreneurship opportunities: Mushroom marketing, business models, and financial planning. Role of mushrooms in sustainable agriculture: Mycoremediation and waste recycling.	12
III	**Post-Harvest Management and Value Addition** Harvesting techniques and quality grading, Drying, packaging, and storage methods, Value-added products: mushroom pickles, powder, soup mix, etc. Marketing channels: local, online, institutional buyers, Organic certification and food safety standards	12
IV	**Mushroom-Based Entrepreneurship** Setting up a mushroom unit: design, layout, equipment, Cost estimation and financial planning, Government schemes, subsidies, and startup support, Preparing business plans and feasibility reports, Case studies of successful mushroom entrepreneurs.	12

Textbook:

- **Chang, S. T. & Miles, P. G. (2004).** *Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact.* CRC Press.

Additional References:

- **Pathak, V. N., Gaur, R. D., & Agarwal, K. C. (1998).** *Mushroom Production and Processing Technology.* Agrobios.
- **Kaul, T. N. (2001).** *Biology and Conservation of Edible Fungi.* Oxford & IBH Publishing.
- **Singh, M. & Vijay, B. (2005).** *Mushroom Cultivation, Marketing, and Consumption.* ICAR.
- **Chang, S. T. (2017).** *Functional Properties of Edible Mushrooms.* Elsevier.
- **Das, S. & Kamal, S. (2020).** *Post-Harvest Technologies of Mushrooms.* Springer.

Online Resources & Industry Guidelines

- **Food and Agriculture Organization (FAO) – Mushroom Cultivation Guide:** www.fao.org

- **ICAR-Directorate of Mushroom Research (India):** www.nrcmushroom.org
- **National Horticulture Board (NHB) Guidelines on Mushroom Farming:** www.nhb.gov.in

Agribusiness and Rural Development
Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective: The course is designed-

- To impart knowledge on the importance and scope of vegetable and spice crop production.
- To educate students on scientific and sustainable practices in cultivation of important vegetable and spice crops.
- To develop skills in nursery management, production planning, and integrated crop management.
- To understand post-harvest, marketing, and export aspects of vegetables and spices.
- To provide insights into agribusiness systems, rural development strategies, and entrepreneurship opportunities.

Course Outcome:

CO1	Explain the ecological requirements and improved varieties of selected crops.	**BT - 2**
CO2	Apply scientific techniques of nursery raising, sowing, and crop management	**BT - 3**
CO3	Analyze constraints in vegetable and spice crop production and suggest improvements	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction and Vegetable Crop Production – I** Importance and scope of vegetable crops in India and globally, Classification of vegetables: botanical, seasonal, and economic, Agro-climatic requirements, nursery techniques, and transplanting, Study of cultivation practices-climate, soil, varieties, sowing, spacing, irrigation, nutrition, pest/disease management, harvesting of Tomato, Brinjal, Chilli, Bhindi (Okra), Cucumber and other cucurbits.	12
II	**Agribusiness Management and Marketing** Cultivation and management of important vegetable crops like Cabbage, Cauliflower, Carrot, Radish, Onion, Garlic, Peas and Beans, Crop protection and	12

	IPM/INM practices, Seed production techniques for vegetable crops, Off-season vegetable production and protected cultivation basics.	
III	**Spice Crop Production – I** Importance, area, and production status of spices in India, Classification of spice crops, Cultivation practices of spice crops like Ginger, Turmeric, Coriander, Cumin, Fenugreek and Fennel.	12
IV	**Spice Crop Production – II & Post-Harvest** Cultivation of other important spice crops like Black Pepper, Cardamom, Clove, Cinnamon, and Nutmeg. Organic production practices in spices, Harvesting indices and techniques, post-harvest handling, processing, packaging, and storage, Marketing and export potential of vegetables and spices.	12

Textbooks:

- Gopalakrishnan, T. R. (2007). *Vegetable crops* (No. 4). New india publishing.
- Thompson, A. K. (2008). Fruit and vegetables: harvesting, handling and storage. John Wiley & Sons.

BASICS OF AGRICULTURAL MARKETING AND TRADE
Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective:

Main objective of this subject is to
1. Acquaint the student about the agriculture marketing, trades and prices.
2. Describes about the agricultural marketing, product life cycle and competitive strategies, pricing.
3. This course provides idea about promotional strategies, marketing process and functions, marketing channels, integration, efficiency, costs and price spread.
4. The course also contains role of Govt. in agricultural marketing, agricultural prices and policy and trade.

Learning Outcomes (Mapped to Bloom's Taxonomy):

CO1	Gain knowledge of optimization of Resource use and Output Management: An efficient agricultural marketing system leads to the optimization of resource use and output management. An efficient marketing system can also contribute to an increase in the marketable surplus by scaling down the losses arising out of inefficient processing, storage and transportation. A well-designed system of marketing can effectively distribute the available stock of modern inputs, and thereby sustain a faster rate of growth in the agricultural sector.	**BT - 2**

CO2	Evaluate the efficient marketing system ensures higher levels of income for the farmers by reducing the number of middlemen or by restricting the commission on marketing services and the malpractices adopted by them in the marketing of farm products.	**BT - 3**
CO3	Understand the marketing system is essential for the success of the development programmes which are designed to uplift the population as a whole.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**AGRICULTURAL MARKETING, DEMAND, SUPPLY AND PRODUCES SUIRPLUS** Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation; Classification and characteristics of agricultural markets; demand, supply; 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 agricommodities	15
II	**PLC AND MARKET PROMOTION** 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; Market promotion – advertising, personal selling; Sales promotion and publicity – their meaning and merits & demerits	15
III	**MARKETIN G FUNCTIONE RIES** 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); 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 and factors	15

	affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs	
IV	**GOVERNAN CE: CONCEPT AND DEVELOPM ENT** 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 and IPR.	15

Total Lecture Hours: 60

CREDIT DISTRIBUTION

LECTURE/TUTORIAL	PRACTICALS	EXPERIENTIAL LEARNING
60	00	30 Home Assignments - Seminars - Viva-voce - Field Visits

Textbooks:

1. Agricultural Economics by Subba Reddy, P. Raghu Ram, T.V. Neelkanta Sastry & I. Bhavani Devi, Second Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Agricultural Marketing in India by S.S. Acharya & N.L. Agarwal, Oxford & IBH Publising Co. Pvt. Ltd, New Delhi
3. Marketing Management: A South Asian Perspective by Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha, Dorling Kindersley (India) Pvt. Ltd. Licensees of Pearson Education in South Asia
4. Fundamentals of Farm Business Management by S.S. Johl and J. R. Kapur, Kalyani Publishers, New Delhi
5. Fundamentals of Agricultural Economics by P.K.Verma and S.K.Nag

MAJOR SUBJECT: **ENVIRONMENTAL STUDIES AND SUSTAINABLE DEVELOPMENT**
Subject Code: | Course Level: 100
L-T-P-C: 1-0-2-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory + Practical (T+P)

Course Objective: This course aims to provide a comprehensive understanding of environmental issues, including pollution, climate change, and waste management, while gaining knowledge of relevant international and Indian environmental treaties and legislation.

Learning Outcomes:

CO1	Explain the national and global efforts to address climate change adaptation and mitigation.	**BT - 2**
CO2	Identify different methods of assessing environmental quality and associated risks.	**BT - 3**
CO3	Analyze how the nations of the world work together for the environment.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Environmental Pollution and Health:** Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution Climate Change: Impacts, Adaptation and Mitigation: Understanding climate change; Impacts, vulnerability and adaptation to climate change; Mitigation of climate change	10
II	**Environmental Management:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights, Environmental management system: ISO 14001 Environmental audit and impact assessment; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme	10
III	**Environmental Treaties and Legislation:** An overview of instruments of international cooperation (COP); Major International Environmental Agreements (UNFCCC, CITES, UNCCD, CBD, Kyoto Protocol, Montreal Protocol, Paris agreement etc.); Major Indian Environmental Legislations; Major International organisations and initiatives.	10
IV	Case studies and Field Works	60

Text Books

1. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp-content/uploads/2020/02/ convention-V-16- CURVE-web.pdf
2. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, h abitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
3. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change? Global Environmental Change—Human and Policy Dimensions 21: 25-33.
4. Ahluwalia, V. K.(2015). *Environmental Pollution, and Health*. The Energy and

Resources Institute (TERI).

DISASTER MANAGEMENT AND ADPATATION STRATEGIES
Subject Code: | Course Level: 100
L-T-P-C: 1-0-2-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory + Practical (T+P)

Course Objective: The course is designed-

Course objectives: The aim of the course is-

- To build foundational knowledge on types of disasters, their causes, and impacts.
- To enable students to assess vulnerabilities and risks in local contexts.
- To impart skills in disaster preparedness, mitigation, and adaptation strategies.
- To train students in community-based disaster response and resilience planning.

Course Outcome:

CO1	Explain disaster risk reduction (DRR) and adaptation frameworks.	**BT - 2**
CO2	Apply mapping, assessment, and preparedness tools for disaster risk analysis.	**BT - 3**
CO3	Analyze community-based strategies and technologies for disaster resilience.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Disaster, Preparedness and Mitigation** Natural and human-induced disasters, Causes and impacts of disasters on agriculture, environment, and livelihoods, Disaster-prone regions in India and global disaster risk trends, Disaster risk: hazard, vulnerability, exposure, and capacity, Principles of disaster risk reduction (DRR), Government policies, NDMA guidelines, Sendai Framework for DRR, Role of institutions: NDRF, SDRF, UN agencies, NGOs	12
II	Climate change and its linkage with disaster frequency and intensity, Adaptation vs. mitigation od disaster, Ecosystem-based adaptation and resilient farming systems, Community-led adaptation practices, Community-based disaster risk management (CBDRM), Role of self-help groups, Panchayats, and youth, Post-disaster response and recovery planning, Rehabilitation, livelihood restoration, and trauma management.	12
III	**Practicals: Disaster Mapping, Risk Assessment, imulation & Planning Exercises** 1. Preparation of hazard zonation maps (using simple GIS tools or manual techniques) 2. Socio-economic and physical vulnerability assessment in local areas.	12

	3. To conduct mock drills for earthquake/flood/fire preparedness **4.** Preparation of a community-based disaster management plan.	
IV	**Field Visits / Case Studies? Group Discussions** 1. Visit to disaster-prone villages, flood protection structures, or relief camps 2. Documentation of indigenous adaptation practices 3. Mini-project on local disaster profile and preparedness strategy	12

Textbooks:

1. Shaw, R., & Krishnamurthy, R. R. (Eds.). (2009). *Disaster management: Global challenges and local solutions*. Hyderabad, India: Universities Press.
2. IPCC. (2014). *Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

ECOLOGICAL RESTORATION AND CONSERVATION
Subject Code: | Course Level: 100
L-T-P-C: 1-0-2-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory + Practical (T+P)

Course Objective: The course is designed-

- To understand the principles and importance of ecological restoration and conservation.
- To study various ecosystem degradation processes and restoration techniques.
- To equip students with practical skills for ecological assessment, monitoring, and biodiversity restoration.
- To promote community-based and landscape-level conservation approaches.

Course Outcome:

CO1	Explain ecosystem degradation processes and identify key indicators of ecosystem health.	**BT - 2**
CO2	Apply field methods and restoration techniques to degraded ecosystems.	**BT - 3**
CO3	Analyze case studies and evaluate community-based conservation approaches.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Ecological Restoration, Conservation Principles and Strategies** Definition, principles, and objectives of ecological restoration, Difference between restoration, rehabilitation, and reclamation, Major causes of ecosystem degradation; Types of biodiversity: genetic, species, ecosystem, In-situ and Ex-situ conservation, Community-based conservation and traditional ecological knowledge (TEK).	12

II	**Ecosystem Restoration, Services and Policy Dimensions** Wetland, forest, and grassland ecosystem restoration, Indicators of ecological health and restoration success, Ecological succession and its relevance to restoration, Role of restored ecosystems in climate mitigation, carbon sequestration, and livelihood support, Ecological economics: valuing ecosystem services, Legal and institutional frameworks: Forest Rights Act, Biodiversity Act, CAMPA, IUCN guidelines, National and global restoration efforts: UN Decade on Ecosystem Restoration	12
III	**Practical based: Ecosystem Assessment, Monitoring and Mapping** 1. Vegetation sampling using quadrats and transects 2. Soil health and water quality assessment 3. Species identification and biodiversity indexing 4. Preparation of ecological restoration site plans 5. Use of GPS for ecological mapping **6.** Restoration success monitoring tools and reporting	12
IV	**Case Studies/ Community Interaction/Project works:** Visit to restored ecosystems, sacred groves, or community conservation areas Interviews with local stakeholders, NGOs, and forest officials Documentation of traditional conservation practices Mini-project on restoration of a degraded patch (college campus or nearby site) Awareness campaign on conservation for school/community	12

Textbooks:

1. Clewell, A. F., & Aronson, J. (2013). *Ecological restoration: Principles, values, and structure of an emerging profession* (2nd ed.). Washington, DC: Island Press.
2. Van Andel, J., & Aronson, J. (Eds.). (2012). Restoration ecology: The new frontier (2nd ed.). Oxford, UK: Wiley-Blackwell.

SOFT SKILL AND PERSONAL GROWTH
Subject Code: | Course Level: 100
L-T-P-C: 2-0-0-2 | Credit Units: 02
SCHEME OF EVALUATION: Theory (T)

Course Objective: The course is designed-

- To enhance essential soft skills like communication, teamwork, and emotional intelligence.
- To build self-awareness, confidence, and a growth-oriented mindset.
- To develop life skills for effective personal and professional behavior.
- To foster a well-rounded personality for success in academics, career, and life

Course Outcome:

CO1	Explain concepts of self-awareness, communication, and emotional intelligence.	**BT - 2**
CO2	Apply interpersonal and time management skills to real-life scenarios.	**BT - 3**
CO3	Analyze one's strengths and areas of improvement for personal growth.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Soft Skills and Self-Awareness** Definition, scope, and importance of soft skills; Key elements in Soft skills: communication, emotional intelligence, adaptability, teamwork; Self-awareness: SWOT analysis; Personal values, beliefs, and attitude; Goal setting: SMART goals for academic and career success	12
II	**Communication and Interpersonal Skills** Verbal and non-verbal communication; Active listening and feedback; Presentation and public speaking skills; Group discussions and teamwork dynamics; Cross-cultural communication and etiquette.	12
III	**Emotional Intelligence and Stress Management** Understanding emotional intelligence (EQ) and its components; Self-regulation and empathy; Conflict resolution and problem-solving techniques; Stress: causes, effects, and coping mechanisms; Mindfulness, meditation, and resilience-building.	12
IV	**Time management techniques**	12

	Procrastination and productivity hacks; Career visioning and decision-making; Resume writing, interview skills, and professional grooming; Personal branding and lifelong learning.	

Textbooks:

1. Goleman, D. (2006). Emotional intelligence: Why it can matter more than IQ. Bantam Books.

2. Covey, S. R. (2004). The 7 habits of highly effective people: Powerful lessons in personal change. Free Press.

STRESS MANAGEMENT & POSITIVE THINKING

Subject Code: | Course Level: 100

L-T-P-C: 2-0-0-2 | Credit Units: 02

SCHEME OF EVALUATION: Theory (T)

Course Objective: The course is designed-

- To help students understand the nature, sources, and impact of stress.
- To introduce scientifically backed stress management techniques.
- To develop a positive and growth-oriented mindset for personal and academic success.
- To encourage emotional balance, resilience, and well-being in daily life.

Course Outcome:

CO1	Explain the psychological and physiological effects of stress.	**BT - 2**
CO2	Apply stress reduction strategies and techniques in real-life situations.	**BT - 3**
CO3	Analyze personal stressors and develop a positive thinking approach to handle the situation.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Stress** Meaning, Definition, Eustress, Distress, Difference between eustress and distress; Frustration, conflict and pressure; Meaning of stressors; common stressors at workplace: Stressor unique to age and gender.	12
II	**Cognitive appraisal and Behavioral aspects of stress** General adaptation of stress; Consequences of stress; Physiological and psychological changes associated with the stress response; Adaptive and	12

	Maladaptive Behaviour; Individual and Cultural Differences: Sources of Stress-Across the Lifespan; College and Occupational Stress.	
III	**Stress and Work performance** Role of communication in managing stress and work performance: Emotional regulation and coping; Emotional intelligence and conflict management: Emotional Basis and Stress; Stress and Conflict in Relationships; Stress and stress reduction techniques.	12
IV	**Positive Thinking and Emotional Resilience** Concept of positive thinking and optimism, Self-talk and reframing negative thoughts, Gratitude, affirmations, and self-compassion, Building resilience: emotional regulation, acceptance, adaptability, Cultivating a growth mindset for academic and life success.	12

Textbooks:

1. Roy, S. (2012). Managing stress, Sterling Publication
2. Greenberg, J. S. (2016). Comprehensive stress management (14th ed.). McGraw-Hill Education.
3. Peale, N. V. (2003). The power of positive thinking. Touchstone.

NCC/NSS (Compulsory Course)
Subject Code: | Course Level: 100
L-T-P-C: 1-0-0-1 | Credit Units: 01
SCHEME OF EVALUATION: Theory (T)

Course Objective: The course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skillful in executing democratic leadership, developing skill in programme development to be able for self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Detailed Syllabus (NSS)

Module	Course Content	Lecture Hours
I	**NSS programmes and activities** Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary.	12
II	**Understanding youth** Definition, profile, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.	12

	Community mobilization Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership.	
III	**Social harmony and national integration** Indian history and culture, role of youth in nation building, conflict resolution and peace- building **Volunteerism and shramdan** Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism	12
IV	**Citizenship, constitution and human rights** Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information Family and society, Concept of family, community (PRls and other community-based organisations) and society Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.	12

Detailed Syllabus (NCC)

Module	Course Content	Lecture Hours
I	1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline. 2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning. 3. Sizing, numbering, forming in three ranks, open and close order march and dressing. 4. Saluting at the halt, getting on parade, dismissing and falling out. 5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and tothe rear.	12
II	6. Turning on the march and wheeling. Saluting on the march. 7. Marking time, forward march and halt. 8. Changing step, formation of squad and squad drill. 9. Command and control, organization, badges of rank, honours and awards. 10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.	12
III	11. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen. 12. Leadership traits, types of leadership. Character/personality development.	12

	13. Civil defense organization, types of emergencies, firefighting, protection, 14. Maintenance of essential services, disaster management, aid during development projects. 15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.	
IV	16. Structure and function of human body, diet and exercise, hygiene and sanitation. 17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. 18. Adventure activities. 19. Basic principles of ecology, environmental conservation, pollution and its control 20. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self-defense.	12

FLORICULTURE
Subject Code: | Course Level: 100
L-T-P-C: 0-0-4-4 | Credit Units: 04
SCHEME OF EVALUATION: Practical (P)

Course objective: The student will learn the techniques of floriculture, the economic importance of different plants used in floriculture and the commercial aspect of floriculture.

Learning Outcomes: After the successful completion of the course the students will be able to:

CO1	**Recognize** field-based application on flower cultivation and marketing.	**BT1**
CO2	**Identify** gardening techniques for different flowers	**BT2**

Detailed Syllabus:

Module	**Content**	**Lecture hours**
I	Importance and scope of floriculture and landscape gardening, Types of gardens, garden elements, styles of gardening, famous gardens in India and abroad, principles of gardening.	**9**
II	Ornamental plants, flowering annuals, herbaceous perennials, divine vines, shade and ornamental trees, ornamental bulbous and foliage plants, cacti and succulents, palms and cycads, ferns and selaginellas, cultivation of plants in pots, indoor gardening, bonsai.	**9**
III	Methods of propagation of flowers, sexual and vegetative methods of propagation, soil sterilization, seed sowing, pricking, planting and transplanting, shading,	**9**

	defoliation, wintering, mulching, topiary, role of plant growth regulators, maintenance of cut flowers	
IV	Commercial floriculture, factors affecting flower production, production and packaging of cut flowers, flower arrangements, methods to prolong vase life, cultivation of important cut flowers (Carnations, Asters, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Lilium, Orchids). Mode of transportation and preservation of loose and cut flowers.	**9**
Total		**36**

Projects based on the syllabus such as:

1. Digital album of world-famous gardens.
2. Development of model gardens in RGU campus.
3. Exhibition of floral arrangements of both fresh and dry flowers.

B. Sc. Course in Agriculture: Semester-III

Paper I Major	**Plant Pathology and crop diseases** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code**

Course Objective:

This course aims to acquaint students with the roles and characteristics of various microorganisms—including fungi, bacteria, viruses, and others in the development of plant diseases, their classification, modes of reproduction, and to provide an understanding of fundamental principles and practices of plant disease management.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define key concepts, terminology, and historical developments in plant pathology, including causes and classification of plant diseases.	1
CO2	Explain the morphological and reproductive characteristics of various plant pathogens such as fungi, bacteria, viruses, and other microorganisms.	2

CO3	Apply laboratory techniques such as staining, culturing, and microscopic examination to diagnose plant diseases and suggest appropriate management strategies.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	Concept of disease in plants; Common terminology in plant pathology; History and development of plant pathology with special reference to India; Causes of plant diseases: Animate and inanimate; Classification of plant diseases; Parasitism and pathogenesis; Disease development: Disease triangle and disease cycle	12
II	**Pathogenic Microorganisms and Their Characteristics** Fungi: Morphology, reproduction, classification Bacteria: Morphology, reproduction, classification of phytopathogenic bacteria Other pathogens: Mollicutes, flagellated protozoa, fastidious vascular bacteria (FVB), green algae, parasitic higher plants Viruses and viroids: Morphology and transmission	12
III	**Principles and Practices of Plant Disease Management** Disease management principles- Chemical control, Host resistance, Cultural and biological control methods Integrated Disease Management (IDM): Concept and practices	12
IV	**Practical Aspects of Plant Pathology** Introduction to laboratory materials and equipment Use of microscope and examination techniques Observation of disease symptoms Microscopic examination of fungi and bacteria Simple, direct/indirect, and Gram staining of bacteria Preparation of culture media and isolation of fungi, bacteria, viruses Pathogen purification	12

	Diagnosis of plant diseases using Koch's Postulates Fungicide types, formulation, methods of application, and dosage calculation	
	Total	48

Textbooks:

1. Agrios, G.N. 2010. Plant Pathology. Acad. Press. Alexopoulos, Mims and Blackwel. Introductory Mycology.
2. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
3. Gibbs, A. and Harrison, B. 1976. Plant Virology - The Principles. Edward Arnold, London

Reference Books:

1. Goto, M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
2. Hull R. 2002. Mathew's Plant Virology. 4th edn. Academic Press, New York.
3. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur.
4. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th edn. Tata Mc Graw Hill Publ. Co. Ltd.

Paper II Major	**Principles of crop Genetics** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code**

Course Objective:

This course aims to provide students with a thorough understanding of classical and molecular genetics, including principles of inheritance, gene structure and function, genetic mapping, gene regulation, and modern molecular techniques used in genetic analysis and biotechnology.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define the pre mendelian concept of the genetics and nature of gene inheritance	1
CO2	Understanding of mendelian population nature, structure, function of genes and genetic material and their role in crop evolution.	2

CO3	Illustrate nature, structure and expression of genetic material	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	Beginning of genetics**,** early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance.	12
II	Mendelian population, Random mating population, Frequencies of genes and genotypes, Causes of change: Hardy-Weinberg equilibrium.	12
III	Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis, Genetic fine structure analysis, Allelic complementation, Split genes, overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes and eukaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression, RNA editing.	12
IV	Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs).	12
	Total	48

Textbooks:

1. Daniel L H and Maryellen R. 2011.Genetics:"Analysis of Genes and Genomes".
2. Gardner E J and Snustad D P.1991.Principles of Genetics. JohnWiley and Sons. 8th ed. 2006

3. Klug W S and Cummings MR. 2003. Concepts of Genetics. Peterson Edu. Pearson Education India;Tenth edition
4. Lewin B. 2008. Genes XII. Jones and Bartlett Publ. (International Edition) Paperback, 2018 Russell PJ.1998. Genetics. The Benzamin/ Cummings Publ. Co

Paper III Major	**Crop Production technology-1 (Kharif crops)** **L-T-P-C: 2-1-1-4 Credit Unit: 4 Evaluation Scheme: T+P**	**Course Code**

Course Objective:

This course aims to impart fundamental knowledge and practical skills on the principles, scientific production, and management practices of Kharif crops.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Recall the origin, distribution, economic importance, and agronomic requirements of major Kharif crops.	1
CO2	Explain the scientific principles of crop production, varietal characteristics, and management practices specific to cereals, pulses, oilseeds, fibre, and forage Kharif crops.	2
CO3	Apply practical skills in nursery management, sowing, weed identification, nutrient application, yield calculation, and forage preservation techniques for effective Kharif crop production.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction and Agronomic Principles of Kharif Crops:** Origin, geographical distribution, and economic importance; Soil and climatic requirements; General cultural practices and yield potential of Kharif crops	12
II	**Crop-wise Study of Major Kharif Crops** **Cereals**: Rice, maize, sorghum, pearl millet, finger millet, and minor millets **Pulses**: Pigeonpea, mungbean, urdbean **Oilseeds**: Groundnut, soybean, sesame, castor **Fibre crops**: Cotton and jute	12

	Forage crops: Sorghum, cowpea, cluster bean, maize, guinea, and napier Varietal selection, cultivation practices, and yield	
III	**Practical Crop Management Techniques** Nursery preparation and transplanting (e.g., rice) Sowing techniques for soybean, pigeonpea, mungbean, maize, groundnut, cotton Effect of seed size and sowing depth on germination and seedling vigour Weed identification and management in Kharif crops Top dressing and foliar nutrient application	12
IV	**Field Work, Observations, and Forage Management** Study of crop varieties and yield contributing characters Yield estimation and biometric observation recording Morphological description of Kharif crops Study of agronomic and forage experiments Silage and hay making Field visits to crop research centres	12
	Total	48

Textbooks:

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production.
2. Kalyani Publishers, New Delhi.
3. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
4. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
5. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.

Paper Minor	Agricultural microbiology and phytoremediation L-T-P-C: 3-1-0-4 Credit Unit: 4 Evaluation Scheme: T	Course Code

Course Objective:

To provide an introduction to microbiology with a focus on its significance in agricultural science, including bacterial structure and function, key fields of microbiology, bioremediation and phytoremediation of polluted soils, and the role of biological control and biopesticides in plant disease management.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Define the basic concepts, history, and applied fields of microbiology relevant to agriculture.	1
CO2	Explain the structural and functional aspects of bacteria, mechanisms of genetic recombination, and the roles of microbes in soil, water, food, and industrial applications.	2
CO3	Apply microbiological concepts to agricultural practices such as biological control, water quality analysis, bioremediation, and the use of PGPR and endophytes for enhancing soil and plant health.	3

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Fundamentals and History of Microbiology** Definition, scope, and applied areas of microbiology; Importance of microbiology in agriculture and allied fields; Historical developments: Discovery of microorganisms, Spontaneous Generation Theory, Germ Theory of Disease; Contributions in immunization, fermentation, and the origin of life	12
II	**Bacteriology and Microbial Genetics** Structure and function of bacterial cells Modes of nutrition: Chemoautotrophy and photoautotrophy Bacterial growth Genetic recombination: Transformation, conjugation, transduction Introduction to genetic engineering	12
III	**Applied Microbiology in Soil, Water, Food, and Industry**	12

	Soil Microbiology: Nutrient mineralization and transformation Air Microbiology: Phyllosphere, phylloplane, and floral microflora Food Microbiology: Spoilage, preservation principles, and food poisoning Water Microbiology: Types of water, microbial analysis (e.g., coliform test), and water purification Industrial Microbiology: Biodegradation, biogas, and biodegradable plastics	
IV	**Microbial Interactions, Biological Control, and Remediation** Biological control and microbial biopesticides in plant disease management Rhizosphere microbiology: Rhizodeposits, biochemical nature, carbon flow Rhizosphere microbiome: Key residents and their functions Plant Growth Promoting Rhizobacteria (PGPR) and endophytes for soil health Bioremediation using microbial mediators Phytoremediation of polluted soils	12
	Total	48

Textbooks:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta
4. Dubey, H.C. 2007. A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi – 10014

Paper AEC I	**Lifestyle Management through Physical Education** **L-T-P-C: 1-0-1-2 Credit Unit: 2 Evaluation Scheme: T+P**	**Course Code**

Course Objective:

The paper will help the student have an awareness regarding the information about positive lifestyle, physical fitness, weight management, food choices, and healthy practices to balance life.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Demonstrate understanding of health, fitness, and nutrition by identifying behaviors that contribute to overall well-being and analyzing factors that influence adolescent nutritional choices.	1
CO2	Evaluate personal nutrition and fitness by assessing individual dietary habits against dietary guidelines and fitness assessments to develop and implement personalized nutrition and fitness plans.	2
CO3	Apply principles of meal planning and energy balance by selecting, preparing, and serving meals that meet specific nutritional needs while exploring the concept of energy intake versus energy expenditure.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Physical Education: Lifestyle Management-** Introduction and Concept of Physical Education and Lifestyle- Meaning and Components of Health; Factors Affecting Health and Lifestyle	12
II	**Sustainable Practices for Positive Lifestyle-** Definition and importance of sustainable health practices; Key elements of sustainable lifestyle for healthy living; Causes and prevention of lifestyle diseases	12
III	**Goal setting for positive lifestyle -** Short-term and long-term Goals for Positive Lifestyle; Dietary Guidelines and Food Pyramid; Sleep management and physical activity	12
IV	**Mental Health and Lifestyle Management -** Introduction to Mental Health; Physical exercise and mental wellbeing; Holistic Lifestyle Management Develop a fitness/ physical activity program for a healthy lifestyle Identify; common lifestyle diseases and design a management program; Prepare a diet plan for a healthy lifestyle	12

	Total	48

Textbooks:

1. Pawar, B., Joshi. A., Chaudhary, V. (2022), "Practical Manual for Physical Education", Friends Publications. New Delhi (India) ISBN-978-93-95829-30-4.
2. Kumar, P (2022). "Assessment & Management of Obesity". Friends Publication (India)
3. Saini N., Suri. M., (2020) "Sports Psycho-Physiology", Friends Publication, New Delhi (India) ISBN-978-93-88457-58-3.
4. "Sports Nutrition and Weight Management", ISBN: 978-93-88269-53-7, the Year 2019, published by Sports Publication, Darya Ganj, New Delhi-110002

Paper AEC II	**Yoga for Mental Health & Stress Management** **L-T-P-C: 2-0-0-2 Credit Unit: 2 Evaluation Scheme: T**	**Course Code**

Course Objective:

The objective of this course is to provide understanding through practical knowledge and practices with enough scope for creativity/Innovations.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Demonstrate understanding of health, fitness, and nutrition by identifying behaviors that contribute to overall well-being and analyzing factors that influence adolescent nutritional choices.	1
CO2	Evaluate personal nutrition and fitness by assessing individual dietary habits against dietary guidelines and fitness assessments to develop and implement personalized nutrition and fitness plans.	2
CO3	Apply principles of meal planning and energy balance by selecting, preparing, and serving meals that meet specific nutritional needs while exploring the concept of energy intake versus energy expenditure.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**

I	**Introduction-** Meaning, Definition, and Importance of Yoga; Origin and Historical Development of Yoga; Concept of the Importance of Yogic Diet.	12
II	**Yoga-Asanas-** Ashtanga Yoga (Maharishi Patanjali): Meaning and importance; Supine Position Asanas (Ardh-Halasana, Sarvangasana, Pawanmuktasana); Prone Position Asanas (Bhujangasana, Salabhasana, Dhanurasana); Sitting Asanas (Ardh Matsyendrasana, Paschimmotanasana, SuptaVajrasana); Standing Asanas (Utkatasana, Trikonasana and Tadasana).	12
III	**Pranayamas And Shat Karmas** Meaning, Procedure, Precautions, and Benefits of the following Pranayamas: Anulom-Vilom, Suryabheden, Bhrameri, Sheetali, Sheetkari Pranayamas. Meaning, Procedure, Precautions, and Benefits of the following Shatkarmas: Kapalbhati, Trataka, and Neti (Jal and sutra). Relevance of yoga for holistic health development in society.	12
IV	**Stress Management -** Concept, Causes, and Effects of Stress. Non-communicable diseases (due to stress), Stress prevention, and good health. Stress Management through relaxation techniques (autogenic training and progressive muscle relaxation, deep breathing, meditation), and sports, recreational, adventure sports, physical activities, and developing healthy relationships as coping strategies.	12
	Total	48

Textbooks:

1. Arora S., Agarwal M. (2022), "Yoga & Stress Management", Khel Sahitya Kendra ISBN: 978-93-90461-38-7.
2. Pawar, B., Gosain, N., Sharma, S. (2021), "Yoga & Stress Management", Friends Publications. New Delhi (India) ISBN-978-81-7216-579-6.
3. Saini, N. (2020). "Yoga & Stress Management", Friends Publications. New Delhi. ISBN: 978-93-88457-58-3
4. Arora S., Agarwal M. (2020), "Yoga Skills", Khel Sahitya Kendra ISBN: 978-81-947808-4-7.

Paper SEC I	3D Graphics Applications in Agriculture L-T-P-C: 2-0-0-2 Credit Unit: 2 Evaluation Scheme: T	Course Code

Course Objective:

To equip students with the knowledge and practical skills to apply 3D graphics technologies for visualizing, modeling, and analyzing agricultural systems and landscapes to enhance planning, precision, and productivity in agriculture.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Define the fundamental concepts of 3D graphics and their applicability in agriculture.	1
CO2	Design and develop 3D models for various agricultural structures and landscapes.	2
CO3	Utilize 3D visualization tools to analyze spatial data for informed decision-making in precision agriculture.	3
CO4	Evaluate emerging 3D technologies and their potential to innovate agricultural practices.	4

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Introduction to 3D Graphics and Agricultural Applications-** Fundamentals of 3D graphics: modeling, rendering, and animation; Overview of 3D graphics software (e.g., Blender, SketchUp); Importance and benefits of 3D visualization in agriculture; Case studies: 3D applications in crop planning and farm layout design	12
II	**3D Modeling Techniques for Agricultural Structures and Landscapes-**Techniques for modeling agricultural structures (greenhouses, storage facilities); Terrain and landscape modeling for farm planning; Integration of Geographic Information Systems (GIS) data into 3D models; Simulation of irrigation systems and drainage planning	12

III	**Data Acquisition and Visualization in Precision Agriculture-** Introduction to data acquisition tools: drones, LiDAR, and satellite imagery; Processing and converting spatial data into 3D models; Visualization of crop health, soil variability, and yield predictions; Use of 3D graphics for monitoring and decision support in precision farming	12
IV	**Advanced Applications and Emerging Technologies in 3D Agricultural Graphics-**Integration of 3D models with Internet of Things (IoT) devices for real-time monitoring; Virtual Reality (VR) and Augmented Reality (AR) applications in agriculture; 3D printing of agricultural tools and components; Future trends: AI-driven 3D modeling and simulation in agriculture	12
	Total	48

Paper SEC II	**Bee Culture** **L-T-P-C: 2-0-0-2 Credit Unit: 2 Evaluation Scheme: T**	**Course Code**

Course Objective:

To provide foundational knowledge and practical skills in beekeeping, bee biology, and the production and marketing of bee products, with an emphasis on self-employment and pollination services in agriculture.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Identify basic tools, equipment, and bee species used in beekeeping and explain the life cycle of honey bees.	1
CO2	Describe the structure and organization of bee colonies and explain the uses of various bee products.	2
CO3	Analyze bee diseases and preventive measures, and assess the potential of apiculture as a self-employment opportunity.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Bee Culture and Bee Biology-**Scope and prospects of bee culture; Varieties and distribution of honey bees, especially *Apis indica;* Social organization and life cycle of honey bee colony	12
II	**Beekeeping Tools and Apiary Management-** Bee rearing (artificial rearing techniques); Types of bee hives: Newtons and Langstroth; Equipment used in beekeeping; Selection of bee species for culture	12
III	**Bee Diseases, Enemies, and Control Measures-** Common bee diseases and enemies; Prevention and control strategies; Hygiene and safety practices in apiary	12
IV	**Bee Products and Entrepreneurship in Apiculture-**Products of beekeeping: Honey, wax, propolis, pollen, etc.; Uses and marketing of bee products; Basics of entrepreneurship and self-employment in apiculture	12
	Total	48

B. Sc. Course in Agriculture: Semester IV

Paper I Major	**Plant breeding-I** **L-T-P-C: 2-0-1-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To acquaint students with plant breeding techniques, from selection to molecular methods, for developing high-yield, stress-resistant varieties to ensure food security.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the fundamentals and genetic basis of plant breeding.	1
CO2	Apply breeding methods for different crop types using conventional and advanced techniques.	2
CO3	Demonstrate practical skills in hybridization, data analysis, and variety release procedures.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals and Genetic Basis of Plant Breeding-**History, concept, and role of plant breeding; Modes of reproduction, apomixis, self-incompatibility, male sterility; Plant genetic resources, domestication, acclimatization, and centers of origin; Genetic variation, heritability, and genetic advance	12
II	**Breeding Methods in Self- and Cross-**Pollinated Crops- Breeding methods: mass selection, pure line selection, hybridization techniques; Population genetics, Hardy-Weinberg Law. Cross-pollinated crops: recurrent selection, ear-to-row methods, heterosis, inbreeding depression. Composite and synthetic varieties	12
III	**Breeding in Asexually Propagated Crops and Advanced Techniques-**Clonal selection and hybridization; Wide hybridization, pre-breeding, and polyploidy; Mutation breeding: methods and applications; Breeding for biotic and abiotic stress tolerance; Participatory plant breeding	12
IV	**Variety Release, IPR, and Practical Applications-** Variety release and notification process; IPR, patents, and Plant Breeder's and Farmer's Rights; Practical skills: emasculation, hybridization, male sterility, population handling, data analysis; Use of statistical tools and experimental designs in breeding trials; Screening techniques for stress tolerance	12
	Total	48

Textbooks:

1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard.
2. Plant Breeding: Principles & Practices by JR Sharma.
3. Plant Breeding- B.D. Singh.
4. Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches by GS Chahal and SS Gosal.
5. Principles of Plant Genetics and Breeding by George Acquaah.

Paper II Major	**Crop physiology and biochemistry-I** **L-T-P-C: 2-0-1-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To provide an in-depth understanding of plant physiological processes, metabolic pathways, and biochemical mechanisms, including how plants respond and adapt to environmental stresses.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the principles of plant-soil-water interactions and nutrient transport mechanisms.	1
CO2	Explain key metabolic processes such as photosynthesis, respiration, nitrogen metabolism, and the role of plant growth regulators.	2
CO3	Analyze biochemical functions and stress responses in plants, including the role of secondary metabolites and strategies for stress tolerance.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Plant-Soil-Water Relations and Nutrient Dynamics-** Plant-soil-water relationships: Water absorption, movement, and retention in plants; Mineral nutrition: Essential nutrients and their physiological roles; Mineral transport: Uptake and translocation mechanisms within plants	12
II	**Metabolic Processes in Plants-**Photosynthesis and photorespiration: Light and dark reactions, efficiency, and regulation; Respiration: Glycolysis, Krebs cycle, and electron	12

	transport; Nitrogen fixation and metabolism: Biological nitrogen fixation and nitrogen assimilation; Plant growth regulators: Types, roles, and mechanisms of action in growth and development	
III	**Plant Biochemistry-** Carbohydrates and lipids: Structure, function, and metabolism; Amino acids, proteins, enzymes, and co-enzymes: Biosynthesis, classification, and functions; Secondary metabolites and defense compounds: Role in plant defense and interactions; Flowering and fruit ripening: Biochemical and hormonal regulation	12
IV	**Stress Physiology in Plants-**Types of stress: Biotic and abiotic stress factors; Stress responses and tolerance mechanisms: Physiological and molecular adaptations; Control and mitigation: Strategies to enhance stress resistance in plants	12
	Total	48

Textbooks:

1. Devlin's Exercises in Plant Physiology by Robert Devlin, Francis H. Witham and David F. Blaydes
2. Fundamentals of Plant Physiology by Lincoln Taiz, Eduardo Zeiger, Ian Max Mølle and Angus Murphy
3. Plant Physiology by Robert M. Devlin and Francis H. Witham
4. Plant Physiology by Lincoln Taiz and Eduardo Zeiger
5. Plant physiology by Frank B. Salisbury and Cleon W. Ross

Paper III Major	**Crop Production technology-II (Rabi crops)** **L-T-P-C: 2-0-1-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To impart basic knowledge of principles and practices of rabi crop production along with scientific skills for effective crop management.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the fundamental principles and practices involved in rabi crop production.	1

CO2	Apply scientific techniques and management practices for efficient rabi crop cultivation.	2
CO3	Develop skills to address common challenges and optimize productivity in rabi farming systems.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction and Agronomy of Rabi Cereals and Pulses-**Origin, distribution, economic importance, soil and climatic requirements; Varieties, cultural practices, and yield of cereals: wheat and barley; Pulses: chickpea, lentil, peas, Rabi redgram, and rajmash	12
II	**Oilseeds and Sugar Crops-** Oilseeds: rapeseed, mustard, sunflower, safflower, linseed; Sugar crops: sugarcane and sugar beet **Tuber, Pseudocereal, and Commercial Crops-** Potato, quinoa, and tobacco: importance, climate, soil, varieties, and cultivation practices	12
III	**Medicinal, Aromatic, and Forage Crops-** Medicinal and aromatic crops: mentha, lemon grass, citronella; Forage crops: barseem, lucerne, oat	12
IV	**Practical:** Sowing methods of wheat; Identification of weeds in rabi season crops; Morphological study of cereals and pulses; Sowing methods of sugarcane; Yield and juice quality analysis of sugarcane; Agronomic experiments related to oilseeds and sugar crops; Oil extraction from medicinal crops; Study of forage crop experiments; Study of yield attributes and morphological traits of tuber and commercial crops; Observation of agronomic experiments related to quinoa, potato, and tobacco	12
	Total	48

Textbooks:

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.
2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
4. Rajendra Prasad. Textbook of Field Crops Production - Foodgrain Crops. Volume I ICAR Publication.

Paper Minor	**Principles of Agricultural Economics and Farm Management** **L-T-P-C: 2-0-1-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective: To impart knowledge on the judicious use of resources for optimum production along with the basic theories of demand, supply, production, and exchange.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand fundamental economic concepts and the role of agricultural economics in development.	1
CO2	Explain the laws of demand, utility, production, and their practical applications in agriculture.	2
CO3	Analyze cost, supply, and distribution mechanisms in economic activities.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Basics of Economics and Agricultural Economics-** Meaning, scope, and types of economics; Basic economic concepts (goods, demand, utility, cost, income); Introduction to agricultural economics and its role in development	12
II	**Demand, Utility, and Production-** Law of demand and elasticity; Utility theory and consumer equilibrium; Basics of production and laws of returns	12

III	**Cost, Supply, and Distribution-** Short-run and long-run cost concepts; Law of supply and elasticity of supply; Introduction to factor markets and distribution (rent, wages, interest, profit)	12
IV	**National Income, Money, and Economic Systems-**National income concepts and measurement; Basics of money and inflation; Overview of economic systems and GST impact	12
	Total	48

Textbooks:

1. Ahuja H.L. (2011). Principles of Microeconomics by. S. Chand and Company Ltd., New Delhi
2. Johl, S.S and T.R Kapur. (2009) Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi
3. Meena G. L. (2022). Fundamentals of Agricultural Economics. Lucky Publishing House, Udaipur
4. Reddy S. Subha, P. Raghu Ram, T.V. Neelakanta and I. Bhvani Devi (2004) Agricultural Economics. Oxford and IBH publishing Co. Pvt. Ltd
5. Sharma L., Acharya S. K. and Somani S. S. (2015). Principles of Agricultural Economics. Agrotech Publishing House, Udaipur.

Paper IDC I	**Agri-Finance, Marketing Risk and Insurance** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To provide students with a comprehensive understanding of agricultural finance, marketing systems, risk assessment, and insurance mechanisms, enabling them to analyze and apply financial and risk management strategies for sustainable agricultural development.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define the fundamental concepts and terminologies related to agricultural finance, marketing, and insurance.	1
CO2	Explain the structure and functioning of agricultural financial systems, marketing mechanisms, and insurance schemes.	2
CO3	Apply appropriate financial and risk management tools to real-world agricultural scenarios to enhance decision-making and sustainability.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Agricultural Finance** Definition, scope, and significance in the agricultural sector. Commercial banks, cooperative banks, regional rural banks, microfinance institutions, and informal credit sources. Understanding balance sheets, income statements, and cash flow statements specific to agricultural enterprises. Budgeting, financial forecasting, and feasibility analysis for farm operations.	12
II	**Agricultural Marketing and Risk Management** Structure and functions of agricultural markets, supply chains, and value addition. Factors influencing agricultural prices, market equilibrium, and government interventions like Minimum Support Prices (MSP). Types of risks including price volatility, demand fluctuations, and quality issues. Futures and options markets, contract farming, hedging strategies, and diversification.	12
III	**Agricultural Insurance Mechanisms** Purpose, importance, and types of agricultural insurance. Detailed study of schemes like Pradhan Mantri Fasal Bima Yojana (PMFBY), National Agricultural Insurance Scheme (NAIS), and Weather-Based Crop Insurance Scheme (WBCIS). Insurance products covering livestock, farm machinery, and other agricultural assets. Procedures for filing claims, assessment of losses, and settlement mechanisms	12
IV	**Advanced Topics in Agri-Finance and Insurance** Use of derivatives, credit instruments, and investment tools in the agricultural sector.	12

	Impact of climate variability on agriculture and the role of insurance in mitigating these risks. Application of ICT, remote sensing, and data analytics in agricultural finance and insurance. Understanding the legal and regulatory aspects governing agricultural finance and insurance in India.	
	Total	48

Textbooks:

1. Krishnamacharyulu C & Ramakrishan L. 2002. Rural Marketing. Pearson Edu.
2. Ramaswamy VS & Nanakumari S. 2006. Marketing Management. 3rd Ed. MacMillan Publ.
3. Singh AK & Pandey S. 2005. Rural Marketing. New Age.
4. Singh Sukhpal. 2004. Rural Marketing. Vikas Publ. House.

Paper IDC II	**Digital Marketing in Agriculture** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

The course aims to introduce digital marketing and blockchain technology, their applications in agriculture, and highlights key tools, methods, and associated challenges.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define the fundamental concepts, terminologies, and tools related to digital marketing and blockchain technology.	1
CO2	Explain the differences between traditional and digital marketing and the role of digital techniques and blockchain in improving agricultural marketing systems.	2
CO3	Apply suitable digital marketing tools and strategies, and interpret the use of blockchain for enhancing transparency, traceability, and efficiency in agri-business.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Digital Marketing** Concept and definition of digital marketing Digital marketing process (Research, Create, Promote, Analyze, Optimize) Key tools and platforms: Google Analytics, Facebook Business, MailChimp, Canva, WordPress Important terms: SEO, PPC, SEM, SMM, ROI, CLV	12
II	**Digital Marketing Techniques and Advantages** Email marketing, affiliate marketing, content marketing, social media marketing Cost-effectiveness, higher conversion rate, measurable results, better customer interaction Digital vs. traditional marketing: Key differences in reach, communication, cost, and impact	12
III	**Digital Marketing Applications in Agriculture** Digital marketing methods for agriculture: Websites, social media, email, paid ads, SEO, mobile and video optimization, content marketing Role of digital marketing in enhancing agricultural outreach and income Challenges and scope of digital adoption in the agri-sector	12
IV	**Blockchain Technology in Agricultural Marketing** Concept and working of blockchain technology Benefits in agriculture: transparency, traceability, smart contracts, insurance, efficient payments Indian scenario and use cases (e.g., Jharkhand seed distribution) Challenges and future potential of blockchain in agriculture	12
	Total	48

Textbooks:

1. Chaudhary, Prabir Rai. (2022). What is Digital Marketing? A Comprehensive Guide, North Hills, USA: Quail Ridge Books.
2. Kumar Saurabh., Saxena Ashutosh. (2020). Block Chain Technology Concepts and Applications, New Jersey, USA: Wiley Publishing Company.
3. Sylvester, Gerard. (2019). E-Agriculture in Action: Block Chain for Agriculture- Opportunities and Challenges, Bangkok: FAO of United Nations and ITU.

Paper IDC III	**Agri based Value addition Management** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

The course aims to equip students with essential knowledge and skills in value addition, processing, marketing, and entrepreneurship to enhance the economic value of agricultural products.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Define the fundamental concepts and significance of value addition in agriculture	1
CO2	Explain various post-harvest and processing techniques, and their impact on product quality and shelf-life.	2
CO3	Apply marketing principles and business strategies to develop and promote value-added agricultural products.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Value Addition in Agriculture** Understanding value addition and its role in enhancing agricultural income. Types of Value Addition: Primary, secondary, and tertiary processing. Economic Impact: Benefits to farmers, entrepreneurs, and the agri-food industry.	12
II	**Post-Harvest Management and Processing Techniques** Post-Harvest Losses: Causes and prevention strategies.	12

	Processing Methods: Drying, canning, fermentation, pickling, and packaging. Quality Standards: Overview of FSSAI, AGMARK, and other relevant standards.	
III	**Marketing and Supply Chain Management** Market Analysis: Identifying market demand and consumer preferences. Branding and Promotion: Strategies for value-added products. Supply Chain Dynamics: Logistics, storage, and distribution channels.	12
IV	**Entrepreneurship and Business Development** Business Planning: Developing business models for value-added products. Financial Management: Cost analysis, pricing, and funding opportunities. Case Studies: Successful agri-based value addition enterprises.	12
	Total	48

Textbooks:

1. Barkley, A., & Barkley, P. W. (2016). Principles of agricultural economics. Routledge.
2. Webber, C. M., & Labaste, P. (2009). Building competitiveness in Africa's agriculture: a guide to value chain concepts and applications. World Bank Publications.
3. Martiin, C. (2013). The world of agricultural economics: an introduction. Routledge.

Paper VAC I	**Agri-informatics** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To equip students with fundamental knowledge and practical skills in computer applications, digital tools, and information technologies relevant to modern agriculture.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the basic concepts of computers, software applications, and database management tailored for agricultural use.	1
CO2	Apply e-agriculture tools, computer models, and mobile apps to improve farm management and decision-making processes.	2
CO3	Utilize geospatial technologies and decision support systems to enhance agricultural planning, resource management, and digital integration.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Fundamentals of Computers and Applications in Agriculture** Introduction to computers, anatomy, memory concepts, and operating systems Basics of MS-Office: creating, editing, formatting documents, data presentation, graphs, and statistical analysis Database concepts, types, creation, and uses of DBMS in agriculture Internet and World Wide Web (WWW) basics	12
II	**Computer Programming and e-Agriculture** General programming concepts and standard input/output operations Introduction to e-Agriculture: concepts, design, and innovative ICT applications in agriculture	12
III	**Computer Models and IT Applications in Agriculture** Computer models in agriculture: statistical, weather analysis, crop simulation (inputs, outputs, limitations, and uses) IT applications for calculating water and nutrient requirements Automated computer-controlled devices for agri-input management	12
IV	**Mobile Apps, Geospatial Technology, and Decision Support Systems**	12

	Smartphone apps for farm advice: market prices, post-harvest management Geospatial technology: concepts, techniques, and agricultural applications Decision support systems and expert systems for agriculture (crop planning, soil information systems) Overview of Digital India initiatives and schemes promoting agricultural digitalization	
	Total	48

Textbooks:

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

Paper VAC II	**Data management in Agriculture** **L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T**	**Course Code**

Course Objective:

To equip students with foundational knowledge and practical understanding of agricultural data systems, emphasizing data sharing principles, responsible use, data analysis, and digital frameworks for smart and inclusive farming.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the significance of agricultural data and apply concepts of farmer profiling for digital agriculture solutions.	1
CO2	Demonstrate awareness of open data principles, responsible data sharing, and personal data protection in agricultural contexts.	2

CO3	Analyze the agricultural data for informed decision-making, and understand the frameworks for data interoperability and reuse.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Agricultural Data and Farmer Profiling** Importance of data in agriculture for productivity and farmer welfare Concepts of digital farmer profiling and business models for data-driven services	12
II	**Principles of Data Sharing** Open and shared data: benefits and challenges Responsible data sharing and ethical considerations Personal data protection in agricultural systems	12
III	**Data Access, Analysis, and Use** Identifying and accessing open agricultural data Data quality, provenance, and visualization techniques Application of open data in policy and decision-making	12
IV	**Data Management and Interoperability** Managing data for reuse and long-term value Frameworks for data sharing and interoperability Open licensing and standards for agricultural data systems	12
	Total	48

Textbooks:

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

Paper VAC III	Big Data and AI in Agriculture L-T-P-C: 2-1-0-3 Credit Unit: 3 Evaluation Scheme: T	Course Code

Course Objective:

To introduce students to the fundamentals of artificial intelligence, digital tools, and computer applications in agriculture, enabling them to effectively utilize modern technologies for smart and data-driven farming.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Understand the basic concepts of artificial intelligence, IoT, and big data, and their applications in agriculture and allied fields.	1
CO2	Gain practical skills in using software tools such as MS Office, programming languages, and crop simulation models for agricultural planning and analysis.	2
CO3	Apply digital technologies including geospatial tools, mobile apps, and AR/VR to support precision farming, agro-advisory services, and smart agriculture initiatives.	3

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Introduction to Artificial Intelligence and Applications in Agriculture** Basics of AI: Introduction, background, and applications Turing Test and control strategies Search techniques: Breadth-first, Depth-first, Best-first, A* algorithm Role of AI in agriculture: crop management, livestock health, intelligent pesticide use, yield mapping, predictive analysis	12
II	**IoT, Big Data, and Smart Agriculture** Concepts of IoT and Big Data Applications in smart farming: automatic weeding, harvesting, produce sorting, food processing	12

	AI in food and nutrition science Overview of smart agriculture and the India Digital Ecosystem of Agriculture (IDEA)	
III	**Basics of Computers and Software Tools in Agriculture** Computer components, accessories, and operating systems (Windows, Unix/Linux) File and folder management, use of DoS commands MS Word and PowerPoint: Creating and editing scientific documents and presentations MS Excel: Spreadsheets, graphs, statistical tools, and data analysis MS Access: Creating databases, queries, and reports	12
IV	**Programming, Crop Models, and Digital Tools in Agriculture** Introduction to programming languages: C, C++, Visual Basic, Java, Fortran Demonstration and hands-on with Crop Simulation Models (CSM) like DSSAT, Crop-Info, Wofost Preparing input files and analyzing outputs from CSM Use of smartphones, agri-apps, geospatial tools, AR/VR in agro-advisory and market dissemination Preparation of contingent crop planning using digital tools	12
	Total	48

Textbooks:

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

Paper SEC I	Vermicomposting L-T-P-C: 0-0-2-2 Credit Unit: 2 Evaluation Scheme: T	Course Code

Course Objective: To provide basic knowledge on vermiculture, composting techniques, and marketing of agricultural and vermicompost products.

Course Outcome:

On successful completion of the course, the students will able to:		Bloom's cognitive level
CO1	Understand the role and biology of earthworms in vermiculture.	1
CO2	Apply vermicomposting techniques for small and large-scale use.	2
CO3	Identify and manage common issues in vermiculture.	3

Detailed Syllabus

Modules	Title of Unit and Contents	Hours
I	**Vermiculture and Agricultural Product Marketing-** Definition, history, economic importance; role in soil health and organic matter recycling.; Key species (*Eisenia fetida*, *Eudrilus eugeniae*); anatomy, reproduction, life cycle, environmental needs.; Small-scale and commercial methods; harvesting and processing; vermiwash; pest and disease management; Benefits of vermicompost for soil and plants; marketing strategies; government and NGO support; Co-operative societies and banks; marketing of major agri-products; role of NAFED; agricultural transportation systems.	12
II	**Key to identify different types of earthworms-** Field trip- Collection of native earthworms & their identification; Study of Sytematic position, habits, and habitat & External characters of *Eisenia fetida*; Study of Life stages & development of *Eisenia fetida*.	12
III	Study of Life stages & development of *Eudriluseugeniae*. Comparison of morphology & life stages of Eisenia fetida & *Eudriluseugeniae*. Study of Vermiculture, Vermiwash & Vermicompost equipments, devices.	12

	Preparation vermibeds, maintenance of vermicompost & climatic conditions.	
IV	Harvesting, packaging, transport and storage of Vermicompost and separation of life stages; Study of verms diseases & enemies; Study the effects of vermicompost & vermiwash on any two short duration crop plants; Study the effects of sewage water on development of worms. Project Report.	12
	Total	48

Textbooks:

1. Dash, M. C. (2012) Charles Darwin's Plough Tool for Vermitechnology, I. K. International Publishing House Pvt Ltd. New Delhi, India.
2. Kumar, A. (2005) Verms and Vermitechnology, APH Publishing.
3. Lekshmy, M. S., Santhi R. (2012) Vermitechnology, Sara Publications, New Delhi, India.

Paper SEC II	**Cloud Computing in Agriculture** **L-T-P-C: 0-0-2-2 Credit Unit: 2 Evaluation Scheme: T**	**Course Code**

Course Objective: To provide basic knowledge on vermiculture, composting techniques, and marketing of agricultural and vermicompost products.

Course Outcome:

On successful completion of the course, the students will able to:		**Bloom's cognitive level**
CO1	Understand the fundamentals of cloud computing and its relevance to agriculture.	1
CO2	Identify and use cloud-based tools and platforms for farm management and data analytics.	2
CO3	Analyze real-time agricultural data using cloud services.	3

Detailed Syllabus

Modules	**Title of Unit and Contents**	**Hours**
I	**Introduction to Cloud Computing-** Definition, characteristics, and service models (IaaS, PaaS, SaaS); Deployment models (Public, Private, Hybrid); Benefits and challenges of cloud computing in agriculture	12
II	**Cloud Applications in Agriculture-** Farm management systems using cloud platforms; Precision agriculture: data collection and analysis through cloud; Remote sensing, IoT integration, and cloud storage; Weather forecasting and climate monitoring via cloud services	12
III	**Case Studies and Platforms-** Case studies on cloud-enabled agriculture (India & global); Overview of platforms: Microsoft Azure FarmBeats, IBM Watson Decision Platform, AWS for Agriculture; Mobile applications and cloud-based advisory services	12
IV	**Practical Applications-**Hands-on with cloud tools for agriculture (Google Earth Engine, OpenWeather API, etc.) Simulating data storage, retrieval, and visualization using cloud services Creating simple dashboards for farm analytics	12
	Total	48

Textbooks:

1. Shrawankar, U., Malik, L., & Arora, S. (Eds.). (2021). Cloud computing technologies for smart agriculture and healthcare. CRC Press.
2. Kishor, K., & Verma, R. K. (2023). Cloud computing-based smart agriculture. In Convergence of Cloud Computing, AI, and Agricultural Science (pp. 120-136). IGI Global.
3. Sharma, A. K., Chanderwal, N., & Khan, R. (Eds.). (2023). Convergence of cloud computing, AI, and agricultural science. IGI Global.

B.Sc Course in Agriculture: Semester-V

MAJOR SUBJECT: AGRICULTURAL ECONOMICS
Subject Code:
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory (T)

Course Objective:
To equip students with fundamental principles of agricultural economics, farm management, and market dynamics relevant to sustainable agricultural practices.
Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the principles and scope of agricultural economics.	**BT - 2**
CO2	Apply knowledge to analyze production, cost, and supply relationships.	**BT – 3**
CO3	Analyze farm business management decisions.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	Nature and scope of agricultural economics; Basic economic concepts and laws; Demand and supply; Elasticity of demand; Consumer surplus; Cardinal and ordinal utility approaches.	12
II	Agricultural production functions; Laws of returns; Cost concepts; Farm planning and budgeting; Risk and uncertainty in agriculture; Farm business types and record keeping.	12
III	Agricultural marketing: functions, channels, and structure; Price determination; Role of APMC, MSP, and warehousing; Agri-marketing institutions; Market intelligence.	12
IV	Agricultural finance: sources, types, and principles; Role of NABARD, RRBs, and cooperative credit; Agricultural insurance and subsidies; Overview of agricultural policies in India.	12

Textbooks:

Raju, V.T. & Rao, D.V.S. (2020). Agricultural Economics: Principles and Practice.
Dewett, K.K. & Varma, J.D. (2019). Elementary Economic Theory.
Acharya, S.S. & Agarwal, N.L. (2021). Agricultural Marketing in India.

Reference Books:

Sadhu, A.N. & Singh, A. (2018). Fundamentals of Agricultural Economics.
Lekhi, R.K. & Singh, J. (2020). Agricultural Economics: An Indian Perspective.
ICAR (2022). Handbook of Agriculture.- ICAR (2021). Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

MAJOR SUBJECT: CROP PHYSIOLOGY AND BIOCHEMISTRY – II
Subject Code: |
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory + Practical

Course Objective: To understand physiological and biochemical processes influencing crop growth, stress adaptation, and metabolic pathways.

Course Outcome:

CO1	Understand physiological mechanisms related to crop growth and yield formation.	**BT - 2**
CO2	Apply knowledge of source–sink dynamics and assimilate partitioning.	**BT - 3**
CO3	Analyze reproductive physiology and yield-determining traits.	**BT - 4**

Detailed Syllabus:

Module	**Course Content**	**Lecture Hours**
I	Concepts of growth and development; Growth analysis parameters (RGR, NAR, LAR, CGR, LAD); Phasic development in cereals and legumes; Physiological classification	12

	of crops; Light interception, radiation use efficiency (RUE); Factors affecting dry matter accumulation and partitioning.	
II	Definition of source and sink; Sink strength and sink limitation; Remobilization of stored assimilates; Phloem loading and unloading; Role of hormones in partitioning; Partitioning under stress vs. non-stress environments; Assimilate partitioning in cereals, legumes, and tuber crops.	12
III	Physiology of flowering and fertilization; Fruit and seed development; Role of floral hormones; Pollen viability and stigma receptivity; Ovule development and fertilization barriers; Grain filling and hormonal regulation; Abscission and seed set under stress conditions.	12
IV	Physiological changes during maturation and ripening; Biochemistry of senescence and perishability; Ethylene synthesis and action; Post-harvest treatments for longevity; Modified atmosphere storage; Antioxidants and respiration control; Pre- and post-harvest treatments to reduce losses.	12

Practicals

1. Measurement of crop growth indices (CGR, RGR, NAR, LAD) using field data
2. Determination of source–sink strength by girdling and defoliation techniques
3. Evaluation of pollen viability and stigma receptivity in selected crops
4. Estimation of ethylene production and post-harvest respiration rate

Textbooks:

- Taiz, L., Zeiger, E., Møller, I.M., & Murphy, A. (2018). Plant Physiology and Development, Sinauer Associates.
- Srivastava, L.M. (2014). Plant Growth and Development: Hormones and Environment, Academic Press.
- Jain, V.K. (2020). Fundamentals of Plant Physiology, S. Chand & Co.

Reference Books:

- Hay, R.K.M., & Porter, J.R. (2006). The Physiology of Crop Yield, Wiley-Blackwell.
- Hopkins, W.G. & Huner, N.P.A. (2021). Introduction to Plant Physiology, Wiley.
- Hsiao, T.C., & Xu, L.K. (2000). Water Use Efficiency and Productivity, CAB International.
- Kays, S.J. & Paull, R.E. (2004). Postharvest Biology, Exon Press.

MAJOR SUBJECT: PLANT BREEDING- – II
Subject Code:
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: Theory + Practical

Course Objective: To impart applied knowledge on breeding for stress resistance, heterosis exploitation, population improvement, and modern biotechnological tools in plant breeding for varietal development.

Course Outcome:

CO1	Understand the concepts of resistance breeding, heterosis, and polyploidy.	**BT - 2**
CO2	Apply mutation and hybridization techniques for genetic improvement.	**BT - 3**
CO3	Analyze population improvement methods and hybrid seed production strategies.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	Mechanisms of disease and insect resistance (vertical and horizontal); Breeding for pest and pathogen resistance: gene-for-gene concept; Sources of resistance; Screening methods and selection; Breeding for drought, salinity, and heat tolerance; Physio-morphological traits associated with stress tolerance.	12
II	Genetic basis of heterosis and inbreeding depression; Types of hybrids (single, double, three-way, top cross); Hybrid seed production using CMS, GMS, SI, and	12

	apomixis systems; Role of male sterility in crops like rice, maize, cotton, and sorghum; Quality control in hybrid seed production.	
III	Types of mutations; Induced mutagenesis: physical and chemical mutagens; Mutation breeding for traits like dwarfism and disease resistance; Polyploidy: types and applications; Role of amphidiploids in crop evolution; Use in sugarcane, wheat, and ornamental crops.	12
IV	Recurrent selection and synthetic/composite variety development; Bulk population breeding; Marker-Assisted Selection (MAS), QTL mapping, and gene pyramiding; Introduction to genomic selection and speed breeding; Integration of phenomics and bioinformatics.	12

Practicals:

1. Screening of germplasm for stress resistance
2. Techniques in hybrid seed production (e.g., emasculation, bagging, CMS line maintenance)
3. Mutagen treatment
4. Demonstration of MAS/QTL tools (simulation or software-based)
5. Visits to seed production fields and breeding research stations

Textbooks:

- Singh, B.D. (2021). *Plant Breeding: Principles and Methods*, Kalyani Publishers
- Choudhary, H.K. (2020). *Elementary Principles of Plant Breeding*, Oxford & IBH
- Sharma, J.R. (2018). *Principles and Practices of Plant Breeding*, Tata McGraw-Hill

Reference Books:

- Poehlman, J.M. & Sleper, D.A. (1995). *Breeding Field Crops*, Blackwell
- Acquaah, G. (2015). *Principles of Plant Genetics and Breeding*, Wiley-Blackwell
- Gupta, P.K. (2022). *Molecular Plant Breeding*, Rastogi Publications
- Collard, B.C.Y. et al. (2005). *Marker-Assisted Selection: A Fast-Track to Increase Genetic Gain*, IRRI

MINOR SUBJECT: AGRICULTURAL BIOTECHNOLOGY
Subject Code: |
L-T-P-C: 3-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective: To provide a detailed understanding of biotechnological tools and techniques for crop improvement, molecular diagnostics, microbial applications, and sustainable agricultural productivity.

Course Outcome:

CO1	Understand the scope, principles, and tools of agricultural biotechnology.	**BT - 2**
CO2	Apply techniques like tissue culture, DNA manipulation, and gene transfer in crops.	**BT - 3**
CO3	Analyze molecular and genomic tools in diagnostics and crop enhancement.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	Historical development and scope of biotechnology in agriculture; DNA, RNA structure, replication, transcription, translation; Restriction enzymes, plasmids, and cloning vectors; Gene libraries and molecular markers.	12
II	**Plant Tissue Culture and Micropropagation:** Totipotency; Callus and suspension cultures; Somatic embryogenesis and organogenesis; Micropropagation techniques and scaling-up; Somaclonal variation; Protoplast isolation and fusion; Embryo rescue, androgenesis, and haploid production.	12

III	**Genetic Engineering and Transgenic Crops**: Gene transfer methods: Agrobacterium-mediated transformation, biolistics, PEG, electroporation; Construction of gene constructs; Marker genes and reporter genes; Development of transgenic crops (Bt cotton, Golden Rice, virus-resistant papaya); Gene silencing, RNAi, and genome editing (CRISPR/Cas).	12
IV	**Molecular diagnostics:** ELISA, PCR, real-time PCR; GMOs: benefits and concerns; Biosafety regulations in India and Cartagena Protocol; Intellectual Property Rights (IPR): patents, trademarks, Plant Variety Protection (PVP), UPOV, and farmer rights under PPV&FR Act.	12

Practicals:

1. Media preparation and explant inoculation
2. Callus induction and regeneration
3. DNA extraction and gel electrophoresis
4. PCR amplification and visualization
5. Agrobacterium-mediated transformation (demonstration)
6. Visit to biotechnology lab / commercial tissue culture unit

Textbooks:

- Dubey, R.C. (2021). *A Textbook of Biotechnology*, S. Chand
- Satyanarayana, U. (2020). *Biotechnology*, Elsevier
- Singh, B.D. (2017). *Biotechnology: Expanding Horizons*, Kalyani Publishers
- Thieman, W.J. & Palladino, M.A. (2018). *Introduction to Biotechnology*, Pearson

Reference Books:

- Brown, T.A. (2016). *Gene Cloning and DNA Analysis*, Wiley-Blackwell
- Primrose, S.B. & Twyman, R.M. (2014). *Principles of Gene Manipulation and Genomics*, Wiley
- Karp, G. (2021). *Cell and Molecular Biology*, Wiley
- ICAR e-Course Material – Agricultural Biotechnology
- FAO & DBT (2022). *Guidelines for Biosafety and Transgenic Research in Agriculture*

MAJOR COURSE: PEST MANAGEMENT IN CROPS AND STORED GRAINS
Subject Code:
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective: To impart knowledge and skills for identifying, monitoring, and managing major insect pests in field crops and stored products using integrated pest management approaches.

Course Outcome:

CO1	Understand pest biology, economic threshold concepts, and principles of pest control.	**BT - 2**
CO2	Apply sampling, surveillance, and forecasting methods for pest outbreaks.	**BT – 3**
CO3	Analyze pest-host-environment interactions and IPM strategies.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Pest Types, Identification, and Ecology: Major** pests of cereals (rice, wheat, maize), pulses, oilseeds (mustard, groundnut), vegetables, and commercial crops (cotton, sugarcane); Pest behavior, life cycle, and economic damage; Concepts of EIL and ETL; Role of abiotic and biotic factors in pest outbreaks.	12
II	**Integrated Pest Management (IPM) in Crops:** Cultural, mechanical, physical, biological, behavioral, and chemical control; Conservation and	12

	augmentation of natural enemies; IPM strategies for major crops; Insecticide resistance management (IRM); Area-wide pest management and forecasting.	
III	**Storage Entomology and Management:Stored grain pests:** biology, identification, and damage symptoms (Sitophilus, Tribolium, Rhizopertha); Principles of storage pest management; Types of storage structures; Sanitation, fumigation, and safe chemical use; Hermetic storage; Rodent control.	12
IV	**Insecticides, Application Technology and Legal Framework:** Classification of insecticides: mode of action, formulations, and compatibility; Pesticide equipment: calibration, nozzles, and coverage; Precautions in pesticide handling and residues; Insecticide Act, CIBRC guidelines, environmental impacts.	12

Practicals:

1. Collection and preservation of pests of major crops
2. Identification and dissection of pests
3. Pesticide formulation calculation and sprayer calibration
4. Monitoring insecticide resistance and IPM implementation
5. Identification of storage pests and damage quantification

Textbooks:

- Srivastava, K.P. (2020). *A Textbook of Applied Entomology*, Kalyani Publishers
- Atwal, A.S. & Dhaliwal, G.S. (2022). *Agricultural Pests of South Asia*, Kalyani Publishers
- Vasantharaj David, B. (2018). *Elements of Economic Entomology*, Popular Book Depot

Reference Books:

- Pedigo, L.P. & Rice, M.E. (2014). *Entomology and Pest Management*, Pearson
- Dhaliwal, G.S. et al. (2010). *Integrated Pest Management: Concepts and Approaches*, Kalyani
- CABI Compendium (2023). *Crop Pest Management Database*
- ICAR (2022). *Pest Management Guidelines*

MAJOR COURSE: DISEASES OF FIELD & HORTICULTURAL CROPS AND THEIR MANAGEMENT Subject Code:
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective: To impart knowledge and skills for identifying, monitoring, and managing major insect pests in field crops and stored products using integrated pest management approaches.
Course Outcome:

CO1	Understand causal organisms, disease cycles, and symptoms of major crop diseases.	**BT - 2**
CO2	Apply principles of disease diagnosis, surveillance, and crop protection.	**BT – 3**
CO3	Analyze disease epidemiology and host-pathogen interactions.	**BT - 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Fungal, Bacterial, and Viral Diseases of Field Crops:** Symptoms, etiology, transmission, and management of major diseases in rice (blast, sheath blight), wheat (rusts, smuts), maize (downy mildew), pulses (wilt, anthracnose), oilseeds	12

	(Alternaria, white rust), sugarcane (red rot, smut), and cotton (boll rot, leaf curl virus).	
II	**Diseases of Horticultural Crops:** Fruits: mango (anthracnose), banana (panama wilt), citrus (canker); Vegetables: tomato (early/late blight), brinjal (little leaf); Spices and plantation crops: black pepper (foot rot), tea (blister blight); Floriculture crops: rose (powdery mildew), marigold (botrytis).	12
III	**Disease Diagnosis and Epidemiology:** Morphological, cultural, and serological diagnosis; Koch's postulates; Disease forecasting and surveillance; Host-pathogen-environment interaction; Role of weather in epidemics; Disease resistance in crops.	12
IV	**Integrated Disease Management (IDM):** Cultural, chemical, biological, and genetic approaches; Fungicide classification and application; Fungicide resistance and safety; Biopesticides and PGPR; Role of ICT and apps in plant disease alerts; Quarantine and legal regulations.	12

Practicals:

1. Identification of symptoms and pathogen isolation
2. Use of media for culturing fungi and bacteria
3. Demonstration of biocontrol agents
4. Fungicide formulation and application
5. Field visit for disease surveillance and sample collection

Textbooks:

- Singh, R.S. (2021). *Plant Diseases*, Oxford & IBH
- Rangaswami, G. & Mahadevan, A. (2020). *Diseases of Crop Plants in India*, Prentice Hall
- Kumar, J. & Saharan, G.S. (2019). *Integrated Plant Disease Management*, Kalyani Publishers

Reference Books:

- Agrios, G.N. (2005). *Plant Pathology*, Elsevier Academic Press
- Thind, T.S. (2017). *Principles and Practices of Plant Disease Management*, Scientific Publishers
- CABI Crop Protection Compendium (2023)

B.Sc Course in Agriculture: Semester- VI

MAJOR SUBJECT: PRINCIPLES OF FOOD SCIENCE & NUTRITION

Subject Code: | Course Level: 100
L-T-P-C: 2-0-1-3 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective:

To introduce the knowledge of biological sciences as a basis for understanding the role of food and nutrients in health and diseases.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the composition of different types of food.	**BT - 2**
CO2	Understand the biochemical nature of different types of food .	**BT - 2**
CO3	Apply the knowledge of nutritional requirement to alleviate diseases.	**BT - 3**
CO4	Analyze the composition, processing, additives and colours of food.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Food science** Definition of food and food science, composition of food, foods of animal origin, digestive system of ruminants.	12
II	**Food biochemistry** Definition, chemistry and function of carbohydrate, fat, proteins, minerals, vitamins and Water.	12
III	**Nutritional requirement and deficiencies** Requirement, availability, functions and nutritional deficiency disease of carbohydrate, fat, proteins, minerals and vitamins.	12
IV	**Food microbiology** Food microbiology with special reference to milk, composition and processing of egg, meat and chicken, types and impact additives and colours used in food, antibiotics, enzymes and hormones.	12

Practical

1. Sampling of milk.
2. Specific gravity of milk by lactometer.
3. Water quality test.
4. Study of nutritional deficiency conditions.
5. Study of Nutritional disorders.
6. Quality parameters for egg, meat and chicken.
7. Fat test by Gerbers method.
8. T.S. & S.N.F. percentage by Richmond's scale and formula.

Textbooks:

1. Swati Gupta and Minna Bagga. 2019. Principles of Food Science and Nutrition. Kalyani Publications.
2. Vijayalakshmi D., Usha Ravindra, Shahshad Begum S. 2019. Satish Serial Publishing House.

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: DRYLAND & RAINFED AGRICULTURE MANAGEMENT

Subject Code: | Course Level: 100
L-T-P-C: 2-0-1-2 | Credit Units: 03
SCHEME OF EVALUATION: T+P

Course Objective:

To introduce students to basic concepts of dryland and rainfed agriculture management practices to develop skills relevant modelling and modern techniques in the planning and management of dryland and rainfed agriculture.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the concept of rainfed and dryland agriculture.	**BT - 2**
CO2	Understand the basic of drought conditions.	**BT - 2**
CO3	Apply the knowledge of crop management practices for better utilization of water and soil.	**BT - 3**
CO4	Analyze the techniques involved in crop planning and management.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Rainfed and dryland agriculture** Introduction, types and history. Problems & prospects of rainfed agriculture in India. Soil and climatic conditions prevalent in rainfed areas.	12
II	**Drought** Types, effect of water deficit on physio - morphological characteristics of the plants.	12
III	**Crop management** Mechanism of crop adoption under moisture deficit conditions. Efficient utilization of water through soil and crop management practices, management of crops in rainfed areas.	12
IV	**Crop planning techniques** Contingent crop planning for aberrant weather conditions. Precision agriculture; concepts and techniques; their issues and concerns for Indian agriculture.	12

Practical

1. Studies on climatic classifications, studies on rainfall pattern are rainfed areas of the country.
2. Studies on cropping pattern of different dryland areas in the country and demarcation of dryland area on map of India.
3. Interpretation of metrological data and scheduling of supplemental irrigations on the basis of evapo-transpiration demand of crops effective rainfall and its calculations.
4. Visit to rainfed research stations/watersheds.

Textbooks:

1. Kawaljeet Kaur, Subhash Chand Dheer Pratap, Akash Bhargaw. Dryland Agriculture & Watershed Management. Satish Serial publishing House.

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: BASIC AND APPLIED STATISTICS

Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: T

Course Objective:

This course is meant to impart knowledge to students on basic statistical tools and techniques. The students would be exposed to concepts of basic statistics that deal with design of experiments, data collection, and analysis.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand different data types and present scientific data.	**BT - 2**
CO2	Understand relevant statistical analysis to experimental data.	**BT - 2**
CO3	Apply the proper experimental design for a particular agricultural research project.	**BT - 3**
CO4	Analyze the data of agricultural research projects and draw the conclusion from the results	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Data types and its presentation** Population, sample, variable, parameter, primary and secondary data, screening and representation of data, frequency distribution, tabulation, bar diagram, histograms, pie diagram.	12
II	**Statistical methods** Mean, median, mode, quartiles and percentiles, variance, standard deviation, standard error, coefficient of variation, probability (frequency approach), independent events, addition and multiplication rules, conditional	12

	probability, examples- poisson and normal distributions, bivariate distribution - correlation coefficient.	
III	**Experimental design** Basic principles of experimental design, types of experimental design, randomized block design, completely randomized block design, split-plot design, complete and incomplete block designs, augmented designs, grid and honeycomb designs.	12
IV	**Hyothesis testing** Testing of Hypothesis- basic concepts of testing of hypothesis, procedure for testing of hypothesis/test of significance, Chi-square test, T-test, Z-test, Tukey's Q Test chi-square test for different attributes, Analysis of Variance (ANOVA)- one way and two way.	12

Textbooks:

1. Le C.T and Eberly L.E (2016). Introductory Biostatistics. 2nd Ed, John Wiley & Sons.
2. Pagano M and Gauvreau K (2000). Principles of Biostatistics. 2nd Ed, CRC Press.

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: SEED SCIENCE & TECHNOLOGY

Subject Code: | Course Level: 100
L-T-P-C: 3-0-0-3 | Credit Units: 03
SCHEME OF EVALUATION: T

Course Objective:

To equip students with the knowledge and skills necessary to produce, process, and test high-quality seeds for agricultural and horticultural crops.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the concept of seed production.	**BT - 2**
CO2	Understand the steps involved in seed quality assessment.	**BT - 2**
CO3	Apply the knowledge of seed act to recognize the regulation and guidelines for better seed quality production.	**BT - 3**
CO4	Analyze the methods of seed processing for its longevity.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Seed and seed production technology** Introduction, definition and importance, history and development of seed Industry in India, deterioration causes of crop varieties and their control, maintenance of genetic purity during seed production.	12
II	**Seed quality assessment** Definition and characters of good quality seed, different classes of seed, foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection.	12
III	**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.	12
IV	**Seed processing** 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, seed marketing, Private and public sectors and their production and marketing strategies.	12

Practical

1. Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra.
2. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea.
3. Seed production in major oilseeds: Rapeseed and Mustard.
4. Seed production in important vegetable crops.
5. Seed sampling and testing: Physical purity, germination, viability, etc.
6. Seed and seedling vigour test.
7. Genetic purity test: Grow out test.
8. Seed certification: Procedure, Field inspection,
9. Preparation of field inspection report.
10. Visit to seed production farms, seed testing laboratories and seed processing plant.

Textbooks:

1. N.C. Singhal. 2016. Seed Science and Technology. Kalyani Publishers.
2. B.S. Jamwal. 2019. Seed Science and Technology. Bioscientific Publisher.
3. K Vanangamudi, K. Vanangamudi. 2014. Seed Science and Technology. Nipa Publisher.

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: GEO-INFORMATICS AND NANOTECHNOLOGY IN AGRICULTURE

Subject Code: | Course Level: 100

L-T-P-C: 2-0-1-2 | Credit Units: 03

SCHEME OF EVALUATION: T+P

Course Objective:

To introduce students to basic concepts of geo-information and nanotechnology, and its application in agriculture.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the basic concepts of geo-informatics.	**BT - 2**
CO2	Understand the concepts and application of GPS in agriculture.	**BT - 2**
CO3	Apply the knowledge of nanotechnology in agriculture.	**BT - 3**
CO4	Analyze the role of nanotechnology in plant protection.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Geo-informatics** Definition, concepts, tool and techniques; their use in precision agriculture, crop discrimination and yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies, spatial data and their management in GIS.	12
II	**Remote sensing** Concepts and application in agriculture, image processing and interpretation, Global positioning system (GPS), components and its functions.	12
III	**Nanotechnology** Definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano- sensors.	12
IV	**Application of nanotechnology**	12

	Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.	

Practical

1. Introduction to GIS software,
2. Introduction to image processing software.
3. Visual interpretation of remote sensing images.
4. Generation of spectral profiles of different objects.
5. Supervised and unsupervised classification and acreage estimation, multispectral remote sensing for soil mapping.
6. Creation of thematic layers of soil fertility based on GIS.
7. Creation of productivity and management zones.
8. Fertilizers recommendations based of VRT and STCR techniques.
9. Crop stress (biotic/abiotic) monitoring using geospatial technology.
10. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture.
11. Projects formulation and execution related to precision farming.

Textbooks:

1. S.R. Reddy. Geoinformatics and Nanotechnology for Precision Farming.
2. Tarun Kumar Upadhyay and Sushil Kumar Sharma. A Textbook on Geoinformatics, Nanotechnology and Precision Farming.
3. Y.S. Satish Kumar, U.V.B. Reddy, and P.V.R.M. Reddy. extbook on Geo Informatics and Nano Technology in Precision Farming.

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT:

Subject Code: | Course Level: 100
L-T-P-C: 2-0-0-2 | Credit Units: 04
SCHEME OF EVALUATION: T

Course Objective:

To provide basic knowledge on international and national intellectual property right policies and their implications in agricultural research and product development

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understanding the Fundamentals of IPR.	**BT - 2**
CO2	Understanding national and international IPR laws.	**BT - 2**
CO3	Apply the knowledge of IPR in patent filing, trademark registration and copyright licensing.	**BT - 3**
CO4	Analyze the role of IPR in agricultural research.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to IPR** Types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, patent databases - country-wise patent searches (USPTO, EPO, India), protection of new GMOs	12
II	**Framework for protection of IP** Introduction to history of GATT, WTO, WIPO, TRIPS, PCT and other treaties for IPR protection, legislations covering IPR in India, Patents Act 1970 its recent amendments and Patent system in India	12
III	**Patent filing** Patent application- forms and guidelines including those of National Bio-diversity Authority (NBA) and other regulatory bodies, fee structure, time frames; types of patent applications: provisional and complete specifications; international patenting-requirement, procedures and costs; financial assistance for patenting-introduction to existing schemes; publication of patents-gazette of India, status in Europe and US; patent infringement- meaning, scope, litigation, case studies and examples; commercialization of patented innovations; licensing – outright sale, licensing, royalty patent specification, patent claims, patent opposition and revocation, infringement, compulsory licensing, patent cooperation treaty, patent search and patent database	12
IV	**IPR in agricultural research** Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. International treaty on plant genetic resources for food and agriculture (ITPGRFA)	12

Textbooks:

1. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.

2. National IPR Policy, Department of Industrial Policy & Promotion, Ministry of Commerce, GoI

3. Office of the Controller General of Patents, Design & Trademarks; Department of Industrial Policy & Promotion; Ministry of Commerce & Industry; Government of India. http://www.ipindia.nic.in/

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: WATERSHED MANAGEMENT

Subject Code: | Course Level: 100
L-T-P-C: 2-0-0-2 | Credit Units: 02
SCHEME OF EVALUATION: T

Course Objective:

To introduce students to basic concepts of Watershed Management Practices to develop skills relevant Watershed modelling and modern techniques in watershed management, particularly the planning of watershed management projects

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the concept of Watershed.	**BT - 2**
CO2	Understand the basic concepts of Watershed Management Practices.	**BT - 2**
CO3	Apply the knowledge in planning and formulation of watershed management through participatory apporach.	**BT - 3**
CO4	Analyze the different watershed management practices.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Watershed** Introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.	12
II	**Watershed management**	12

	Concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed. Appropriate techniques for management of different types of degraded watersheds.	
III	**Participatory watershed management** Role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.	12
IV	**Management measures** Rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated watershed management - concept, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation.	12

Textbooks:

1. Engineering Hydrology – K. Subramanya
2. Garg, S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi.
3. Hydrology & Soil Conservation Engineering – Ghansyamdas
4. Hydrology – Raghunath
5. Integrated Watershed Management through Simulation Modeling by Lodha P P and Gosain A K – Lambert Academic Publishing
6. Introduction to Hydrology – Warren Viessman, Jr. & Garry L. Lewis, Pearson Education
7. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.
8. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
9. Stochastic Water Resources Technology – N.T. Kottegoda
10. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000
11. Watershed Hydrology – Peter E. Black, Prentice Hall.Arora, K.R., Irrigation, Water Power And Water Resources Engineering, Standard Publisher Distributors, Delhi

B.Sc Course in Agriculture: Semester-VI

MAJOR SUBJECT: PRECISION FARMING & SUSTAINABLE AGRICULTURE

Subject Code: | Course Level: 100

L-T-P-C: 2-0-0-2 | Credit Units: 02

SCHEME OF EVALUATION: T

Course Objective:

To introduce students to basic concepts of farming system and sustainable agriculture for production efficiency, and conservation and integrated management of agriculture.

Course Outcome:

On successful Completion of the course, the student will be able to:

CO1	Understand the concept of different types of farming systems.	**BT - 2**
CO2	Understand different types of cropping systems and their efficient use.	**BT - 2**
CO3	Apply the knowledge of sustainable agriculture in conservation and integrated management of agriculture.	**BT - 3**
CO4	Analyze the techniques used for sustainable agriculture.	**BT- 4**

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Farming System** Scope, importance, and concept, types and systems of farming system and factors affecting types of farming, farming system components and their maintenance.	12
II	**Cropping system** Patterns, multiple cropping system, efficient cropping system and their evaluation, allied enterprises and their importance, tools for determining production and efficiencies in cropping and farming system.	12
III	**Sustainable agriculture** Problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, integrated farming system-historical background.	12
IV	**Techniques in sustainable agriculture** HEIA, LEIA and LEISA and its techniques for sustainability, objectives and characteristics, components of IFS and its advantages, site specific development of IFS model for different agro-climatic zones, resource use efficiency and	12

	optimization techniques, resource cycling and flow of energy in different farming system, farming system and environment	

Textbooks:

1. Qin Zhang. 2016. Precision Agriculture Technology for Crop Farming. Taylor and Francis.

2. Sanjeev Kumar, S.N. Saravaiya, A.K. Pandey. 2021. Precision Farming and Protected Cultivation Concepts and Applications. Taylor and Francis.

Semester - VII

MAJOR SUBJECT: Agroforestry

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective: To introduce the principles of agroforestry, its components, and its relevance in developing sustainable land-use systems that integrate trees, crops, and/or livestock for enhanced productivity, profitability, and environmental resilience.

Course Outcome: On successful completion of the course, the student will be able to:

CO	Course Outcome	BT Level
CO1	Understand the basic concepts, scope, and importance of agroforestry systems.	BT-2
CO2	Identify and classify different agroforestry systems and their components.	BT-3
CO3	Apply principles of agroforestry design and management for sustainable production and conservation.	BT-3
CO4	Analyze the socio-economic and ecological benefits of agroforestry.	BT-4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Fundamentals of Agroforestry** Definition, scope, and objectives of Agroforestry; Historical perspective and current status of Agroforestry in India and globally; Agroforestry vs. traditional farming and forestry; Benefits of agroforestry (ecological, economic, social); Constraints and opportunities in agroforestry.	**12**
II	**Agroforestry Systems and Classification** Components of agroforestry systems (trees, crops, livestock, soil, environment); Classification of agroforestry systems based on structure, function, socio-economic factors, and ecological zones; Major agroforestry systems: Agrisilviculture (alley cropping, shelterbelts, homegardens), Silvopastoral systems, Agrosilvopastoral systems, and other specialized systems (e.g., apiculture with trees, aquaforestry).	**12**
III	**Design and Management of Agroforestry Systems** Principles of agroforestry design; Species selection for agroforestry (multipurpose trees, crop and livestock compatibility); Tree-crop-livestock interactions (positive and negative); Nursery establishment and management for agroforestry species; Planting techniques and management of agroforestry systems (pruning, thinning, lopping); Soil fertility and water management in agroforestry.	**12**
IV	**Economics, Extension, and Policy in Agroforestry** Economic analysis of agroforestry systems (cost-benefit analysis, market potential); Diagnosis and Design (D&D) methodology for agroforestry projects; Role of agroforestry in climate change mitigation and adaptation; Agroforestry extension methodologies; National and international policies and programs promoting agroforestry; Case studies of successful agroforestry models.	**12**

Practicals:

1. Identification and characterization of common multipurpose tree species used in agroforestry.
2. Study of different agroforestry systems in the local region/campus.
3. Visit to successful agroforestry farms/research stations.
4. Techniques for nursery raising of important agroforestry tree species.
5. Design and layout of selected agroforestry systems (e.g., alley cropping, silvopasture).
6. Analysis of tree-crop interface and allelopathic effects.
7. Estimation of biomass and carbon sequestration potential in agroforestry systems (demonstration).
8. Economic analysis of a model agroforestry system.

Textbooks:

1. Dhyani, S.K. (2020). *Agroforestry: Principles and Practices*. New India Publishing Agency.
2. Nair, P.K.R. (1993). *An Introduction to Agroforestry*. Kluwer Academic Publishers.
3. Dwivedi, A.P. (1992). *Agroforestry: Principles and Practices*. Oxford & IBH Publishing Co. Pvt. Ltd.
4. Pathak, P.S., & Newaj, R. (Eds.). (2017). *Agroforestry Systems and Practices*. New India Publishing Agency.
5. Shukla, S.K., & Dhyani, S.K. (Eds.). (2021). *Agroforestry for Climate Resilience and Rural Livelihoods*. Springer.
6. Pandey, D.N. (2007). *Multifunctional Agroforestry Systems in India*. Scientific Publishers.
7. Garrett, H.E. (Ed.). (2009). *North American Agroforestry: An Integrated Science and Practice* (2nd ed.). American Society of Agronomy.
8. Jose, S., & Gordon, A.M. (Eds.). (2008). *Toward Agroforestry Design: An Ecological Approach*. Springer.

MAJOR SUBJECT: Renewable Energy in Agriculture and Allied Sectors

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To introduce the fundamental principles of renewable energy technologies and their applications in agricultural production, processing, and rural development for enhanced sustainability and energy efficiency.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Statement	BT Level

CO1	Understand the basic concepts and scope of various renewable energy sources in agriculture.	BT-2
CO2	Identify and classify different renewable energy technologies applicable to allied sectors.	BT-3
CO3	Analyze the feasibility and integration of renewable energy systems in farm operations.	BT-4
CO4	Apply principles of renewable energy for sustainable agricultural development.	BT-4

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**
I	**Introduction to Renewable Energy in Agriculture:** Energy in Agriculture: Conventional vs. Renewable Sources; Importance and Scope of Renewable Energy in Agriculture; Overview of Different Renewable Energy Sources (Solar, Wind, Biomass, Biogas, Hydro); National and Global Scenario; Policies and Subsidies.	12
II	**Solar and Wind Energy Applications:** Solar Energy: Solar Radiation, Collectors, Solar Photovoltaic Systems, Solar Water Heaters, Solar Dryers, Solar Pumping Systems, Solar Fencing. Wind Energy: Wind Resources Assessment, Wind Turbines (Types, Components), Windmills for Water Pumping and Electricity Generation.	12
III	**Biomass and Biogas Technologies:** Biomass: Sources (Agricultural Residues, Agro-industrial Wastes, Energy Plantations), Conversion Technologies (Combustion, Gasification, Pyrolysis, Briquetting). Biogas: Principles of Anaerobic Digestion,	12

	Biogas Plant Designs, Feedstock Management, Utilization of Biogas and Slurry.	
IV	**Integrated Renewable Energy Systems and Sustainability:** Other Renewable Sources: Small Hydropower, Geothermal Energy, Biofuels (Biodiesel, Ethanol) from Agricultural Produce. Integrated Renewable Energy Systems for Farms; Energy Auditing in Agriculture; Economic and Environmental Aspects of Renewable Energy Use; Case Studies.	12

Practicals:

1. Study of different types of solar energy gadgets: solar cookers, solar dryers, solar water heaters.
2. Hands-on training on photovoltaic (PV) system components and installation for lighting and water pumping.
3. Familiarization with wind measuring instruments and assessment of wind energy potential.
4. Visit to a functional biogas plant and study of its components and operation.
5. Demonstration of biomass densification (briquetting/pelleting) techniques.
6. Estimation of energy consumption patterns on a model farm.
7. Analysis of the economic viability of different renewable energy systems for agricultural applications.
8. Case study preparation on successful integrated renewable energy farming systems.

Textbooks:

1. Rai, G.D. (2017). *Non-Conventional Energy Sources*. Khanna Publishers.
2. Kothari, D.P., Singal, K.C., & Ranjan, R. (2016). *Renewable Energy Sources and Emerging Technologies*. PHI Learning Pvt. Ltd.
3. Twindell, J., & Weir, T. (2015). *Renewable Energy Resources* (3rd ed.). Routledge.
4. Sørensen, B. (2017). *Renewable Energy: Physics, Engineering, Environmental Impacts, Economics & Planning* (5th ed.). Academic Press.
5. Mukherjee, D., & Chakrabarti, S. (2004). *Fundamentals of Renewable Energy Systems*. New Age International.
6. Boyle, G. (Ed.). (2012). *Renewable Energy: Power for a Sustainable Future* (3rd ed.). Oxford University Press.
7. Mittal, K.M. (1997). *Non-conventional Energy Systems: Principles, Progress and Prospects*. Wheeler Publishing.
8. Rathore, N.S., Kurchania, A.K., & Panwar, N.L. (2009). *Renewable Energy Technology for Agricultural and Rural Development*. Himanshu Publications.

MAJOR SUBJECT: Weed Management

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To impart comprehensive knowledge about weeds, their management principles, and the judicious use of herbicides for sustainable crop production.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	**Description**	**BT Level**
CO1	Understand the fundamental concepts of weed science, including weed biology, ecology, and crop-weed interactions.	BT - 2
CO2	Identify and classify common weeds and herbicides, and comprehend various methods of weed control.	BT - 3
CO3	Apply integrated weed management strategies for effective and environmentally sound weed control in diverse cropping systems.	BT - 4
CO4	Develop practical skills in weed identification, herbicide application, and the assessment of weed control efficacy.	BT - 4

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**
I	**Introduction to Weed Science:** Definition, Characteristics, and Disadvantages of Weeds; Classification of Weeds; Benefits of Weeds; Weed Biology and Ecology: Weed Seed Production, Dispersal, Dormancy, Persistence, and Germination; Crop-Weed	12

	Competition: Critical Period, Factors Affecting; Allelopathy: Concept and Importance.	
II	**Principles and Methods of Weed Control:** Principles of Weed Control: Prevention, Eradication, Control, and Management; Methods of Weed Control: Cultural (Crop Rotation, Stale Seed Bed, Intercropping, Mulching, Solarization), Mechanical (Tillage, Hoeing, Hand Weeding, Mowing, Burning, Dredging), Biological (Classical, Augmentative, Bioherbicides), and Chemical Control. Integrated Weed Management (IWM): Concept, Advantages, and Components.	12
III	**Herbicides and Their Application:** Herbicides: Definition, Advantages, and Limitations; Classification of Herbicides (Based on Chemical Nature, Mode of Action, Selectivity, Time of Application, Method of Application); Herbicide Formulations and Adjuvants; Herbicide Absorption, Translocation, and Metabolism in Plants; Factors Affecting Herbicide Efficacy; Herbicide Selectivity; Herbicide Persistence in Soil and Plants; Herbicide Residues and Management; Herbicide Resistance in Weeds and its Management.	12
IV	**Weed Management in Cropping Systems and Specific Situations:** Weed Management in Major Field Crops (e.g., Rice, Wheat, Maize, Pulses, Oilseeds); Weed Management in Major Horticultural Crops (e.g., Vegetables, Fruits); Management of Problematic Weeds (e.g., Perennial Weeds like *Cyperus rotundus*, *Cynodon dactylon*; Parasitic Weeds like *Orobanche*, *Striga*, *Cuscuta*); Weed Management in Non-Cropped Areas (Aquatic environments, Pastures, Industrial sites); Herbicide Application Equipment: Sprayers and Nozzles, Calibration; Safety Precautions in Herbicide Handling and Use.	12

Practicals:

1. Identification of common weeds in different crops and their scientific names.
2. Determination of weed density, frequency, and abundance.
3. Calculation of weed indices (e.g., Weed Control Efficiency, Weed Index).
4. Study of different mechanical and cultural weed control methods and implements.

5. Herbicide label interpretation: active ingredient, formulation, dose, precautions.
6. Study of different types of herbicide nozzles and sprayers.
7. Calibration of sprayers (e.g., knapsack sprayer, boom sprayer).
8. Preparation of herbicide spray solutions and practice of field application.
9. Assessing herbicide phytotoxicity symptoms on weeds and crops.
10. Collection, pressing, and mounting of weed specimens for herbarium preparation.
11. Study of allelopathic effects of selected weeds on crop seed germination.

Textbooks:

1. **Rao, V.S. (2000).** *Principles of Weed Science.* Oxford & IBH Publishing Co. Pvt. Ltd.
2. **Subramanian, S., Ali, A.M., & Kumar, R.J. (1997).** *All About Weed Control.* Kalyani Publishers.
3. **Gupta, O.P. (2007).** *Weed Management: Principles and Practices.* Agrobios India.
4. **Das, T.K. (2011).** *Weed Science: Basics and Applications.* Jain Brothers.
5. **Reddy, S.R. (2009).** *Principles of Weed Science.* Kalyani Publishers.
6. **Zimdahl, R.L. (2018).** *Fundamentals of Weed Science.* (5th Edition). Academic Press.
7. **Monaco, T.J., Weller, S.C., & Ashton, F.M. (2002).** *Weed Science: Principles and Practices.* (4th Edition). John Wiley & Sons.
8. **Chauhan, B.S., Mahajan, G., & Walsh, M. (Eds.). (2017).** *Non-chemical Weed Control.* Academic Press.

MAJOR SUBJECT: Soil Fertility Management

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To impart comprehensive knowledge of soil fertility principles, nutrient dynamics, and sustainable management practices for optimizing crop production and maintaining soil health.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Statement	BT - Level
CO1	Understand the fundamental concepts of soil fertility, essential plant nutrients, and their roles.	BT - 2

CO2	Identify different sources of plant nutrients and explain nutrient transformation processes in the soil.	BT - 3
CO3	Apply principles of soil fertility assessment and fertilizer recommendations for various crops.	BT - 4
CO4	Develop integrated nutrient management strategies for sustainable agriculture and soil health.	BT - 4

Detailed Syllabus

Modu le	Course Content	Lecture Hours
I	**Introduction to Soil Fertility and Plant Nutrition:** Definition, Scope, and Importance of Soil Fertility; Soil as a Nutrient Reservoir; Essential Plant Nutrients: Criteria of Essentiality, Classification (Macro and Micro-nutrients), Forms available to plants, Functions, and Deficiency Symptoms; Nutrient Uptake Mechanisms by Plants.	**12**
II	**Soil Organic Matter and Nutrient Cycling:** Composition, Properties, and Significance of Soil Organic Matter (SOM); Humus: Formation and Role; Carbon, Nitrogen, Phosphorus, and Potassium Cycles in Soil; Biological Nitrogen Fixation: Symbiotic and Non-symbiotic; Role of Microorganisms in Nutrient Transformation and Availability.	**12**
III	**Manures, Fertilizers, and Biofertilizers:** Organic Manures: Types (FYM, Compost, Vermicompost, Green Manures, Oil Cakes), Preparation, Nutrient Content, and Benefits; Chemical Fertilizers: Classification (Nitrogenous, Phosphatic, Potassic, Complex), Properties, Reactions in Soil, and Efficient	**12**

	Use; Biofertilizers: Types, Production, Methods of Application, and Advantages.	
IV	**Soil Fertility Evaluation and Management:** Soil Sampling Techniques; Soil Testing: Objectives and Methods; Plant Analysis as a Diagnostic Tool; Critical Nutrient Levels; Fertilizer Recommendation Approaches; Integrated Nutrient Management (INM): Concept and Components; Management of Soil Fertility in Problematic Soils (Acid, Saline, Alkaline); Site-Specific Nutrient Management (SSNM).	**12**

Practicals:

1. Collection and preparation of soil samples for analysis.
2. Determination of soil pH and Electrical Conductivity (EC).
3. Estimation of soil organic carbon by Walkley and Black method.
4. Estimation of available Nitrogen (N) in soil.
5. Estimation of available Phosphorus (P) in soil.
6. Estimation of available Potassium (K) in soil.
7. Identification of common fertilizers and manures.
8. Calculation of fertilizer doses for different crops.
9. Preparation of enriched compost/vermicompost.

Textbooks:

1. Havlin, J.L., Tisdale, S.L., Nelson, W.L., & Beaton, J.D. (2016). *Soil Fertility and Fertilizers: An Introduction to Nutrient Management* (8th ed.). Pearson.
2. Brady, N.C., & Weil, R.R. (2016). *The Nature and Properties of Soils* (15th ed.). Pearson.
3. Das, D.K. (2011). *Introductory Soil Science* (3rd ed.). Kalyani Publishers.
4. Reddy, S.R. (2019). *Principles of Agronomy* (4th ed.). Kalyani Publishers. (Relevant chapters on nutrient management)
5. Yawalkar, K.S., Agrawal, J.P., & Bokde, S. (2017). *Manures and Fertilizers* (10th ed.). Agri-Horticultural Publishing House.
6. Tandon, H.L.S. (Ed.). (2013). *Fertilizer Recommendations for Horticultural Crops in India* (3rd ed.). Fertiliser Development and Consultation Organisation (FDCO).
7. Subba Rao, N.S. (2017). *Biofertilizers in Agriculture and Forestry* (4th ed.). CBS Publishers & Distributors.

MAJOR SUBJECT: Essentials of Horticulture Subject Code: | Course Level: L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To introduce the fundamental principles of horticultural science, covering the basics of fruit, vegetable, flower, and plantation crop production, propagation techniques, orchard/garden management, and post-harvest handling, aiming to equip students with foundational knowledge for sustainable horticultural practices.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	**Course Outcome**	**BT Level**
CO1	Understand the basics, scope, and importance of horticulture and classify horticultural crops.	BT - 2
CO2	Identify and describe various propagation techniques and nursery management practices.	BT - 3
CO3	Apply fundamental principles to the cultivation of common horticultural crops (fruits, vegetables, flowers).	BT - 4
CO4	Understand the principles of orchard/garden establishment, management, and basics of post-harvest handling.	BT - 3

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**

I	**Fundamentals of Horticulture** Horticulture: Definition, Branches, Importance and Scope; Horticultural Zones of India and [Specific Region, e.g., Assam, if applicable]; Classification of Horticultural Crops (Pomological, Olericultural, Floricultural, Plantation Crops, Spices and Condiments, Medicinal and Aromatic Plants); Role of horticulture in nutritional security, economic development, and environmental conservation.	**12**
II	**Plant Propagation and Nursery Management** Methods of Propagation: Sexual and Asexual (Cuttings, Layering, Grafting, Budding); Advantages and Disadvantages of each; Propagation Structures (Greenhouse, Polyhouse, Net-house, Mist chamber); Nursery Bed Preparation and Management; Rootstocks: Selection and Influence; Seed Dormancy and Germination; Plant Growth Regulators in Horticulture.	**12**
III	**Orchard and Garden Management** Principles of Orchard Establishment: Site Selection, Layout, Planting Systems (Square, Rectangular, Quincunx, Hexagonal, Contour); Training and Pruning: Principles and Methods; Irrigation and Water Management; Nutrient Management: Manures, Fertilizers, Integrated Nutrient Management (INM); Weed Management in Horticultural Crops; Intercultural Operations; Cropping Systems in Horticulture (Multitier, Intercropping).	**12**
IV	**Cultivation Practices and Post-Harvest Basics** Introduction to cultivation practices of important Fruit crops (e.g., Mango, Banana, Citrus, Guava, Papaya), Vegetable crops (e.g., Tomato, Brinjal, Okra, Cucurbits, Leafy vegetables), and Flower crops (e.g., Rose, Marigold, Jasmine); Principles of Organic Horticulture; Introduction to Protected Cultivation; Harvesting, Handling, and Maturity Indices; Causes of Post-Harvest Losses; Principles of Storage and Preservation of horticultural produce.	**12**

Practicals:

1. Identification of horticultural tools, implements, and machinery.
2. Preparation of nursery beds and sowing of seeds/cuttings.
3. Practice of sexual and asexual propagation methods (e.g., T-budding, patch budding, layering).
4. Layout of different planting systems in an orchard.
5. Demonstration of training and pruning techniques in fruit trees.
6. Identification of common fruits, vegetables, and ornamental plants.
7. Preparation of potting mixture and potting of plants.
8. Visit to a commercial nursery/orchard/horticultural research station.

Textbooks:

1. Singh, Jitendra. *Basic Horticulture*. Kalyani Publishers.
2. Chadha, K.L. *Handbook of Horticulture*. Indian Council of Agricultural Research (ICAR).
3. Kumar, N. *Introduction to Horticulture*. Oxford & IBH Publishing Co. Pvt. Ltd.
4. Bose, T.K., Mitra, S.K., & Sanyal, D. (Eds.). *Tropical and Subtropical Fruits*. Naya Udyog.
5. Bose, T.K., Som, M.G., & Kabir, J. (Eds.). *Vegetable Crops*. Naya Prokash.
6. Adams, C.R., Early, M.P., Bamford, K.M. & Hamilton, A.P. *Principles of Horticulture*. Routledge.
7. Peter, K.V. (Ed.). *Basics of Horticulture*. New India Publishing Agency.
8. Reddy, T. Yellamanda & Reddy, G.H.S. *Principles of Agronomy* (Relevant sections on horticulture). Kalyani Publishers.

MAJOR SUBJECT: Essentials of Fisheries Science

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To introduce the fundamental principles of fisheries science, covering aquatic ecosystems, fish biology, aquaculture practices, and fisheries management for sustainable fish production.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Course Outcome	BT-2

CO1	Identify common fish species and understand their biology and ecology.	BT-3
CO2	Apply principles of aquaculture for fish production and resource management.	BT-4
CO3	Comprehend the basics of fish health, post-harvest technology, and economics.	BT-2

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Fisheries Science:** Definition, Scope, and Importance; History of Fisheries; Global and Indian Fisheries Scenario; Aquatic Ecosystems (Freshwater, Brackishwater, Marine): Characteristics and Classification; Limnology: Physico-chemical parameters of water; Plankton and Benthos: Classification and Importance.	12
II	**Fish Biology and Systematics:** Classification of Fishes; Morphology and Anatomy of Finfish and Shellfish; Biology of Commercially Important Fish Species (e.g., Carps, Catfishes, Prawns, Tilapia); Fish Physiology: Respiration, Excretion, Osmoregulation, Reproduction, Growth; Food and Feeding Habits of Fish.	12
III	**Aquaculture Principles and Practices:** Principles of Aquaculture; Types of Aquaculture Systems (Extensive, Semi-intensive, Intensive); Pond Preparation and Management; Seed Procurement and Rearing; Feed Management in Aquaculture; Water Quality Management; Introduction to Integrated Fish Farming Systems.	12

IV	**Fisheries Management, Fish Health, and Post-Harvest:** Basic Concepts of Fisheries Management and Conservation; Common Fish Diseases: Symptoms, Prevention, and Control; Introduction to Fish Genetics and Breeding; Fish Harvesting Methods; Principles of Fish Preservation and Processing; Value Addition of Fish Products; Basics of Fisheries Economics and Marketing.	12

Practicals:

1. Identification of common freshwater, brackishwater, and marine fishes.
2. Study of external morphology and internal anatomy of a finfish.
3. Analysis of physico-chemical parameters of water (pH, temperature, turbidity, dissolved oxygen).
4. Identification of common aquatic weeds and plankton.
5. Demonstration of induced breeding techniques (subject to availability).
6. Visit to a fish farm and fish market.

Textbooks:

1. Bardach, J.E., Ryther, J.H. & McLarney, W.O. (1972). *Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms*. Wiley-Interscience.[1]
2. Chakrabarti, N.M. (2007). *Biology of Indian Major Carps*. Narendra Publishing House.
3. Jhingran, V.G. (1991). *Fish and Fisheries of India*. Hindustan Publishing Corporation.
4. Pillay, T.V.R. & Kutty, M.N. (2005). *Aquaculture: Principles and Practices* (2nd ed.). Blackwell Publishing.
5. Reddy, P.S. & Rao, K.S. (2019). *Textbook of Fish and Fisheries*. New Age International Publishers.
6. Santhanam, R., Ramanathan, N. & Jegatheesan, G. (1989). *Coastal Aquaculture*. CBS Publishers & Distributors.
7. Srivastava, C.B.L. (1999). *A Textbook of Fishery Science and Indian Fisheries*. Kitab Mahal.
8. Welcomme, R.L. (1988). *Inland Fisheries Management*. Food and Agriculture Organization of the United Nations.

MINOR SUBJECT: Fundamentals of Seed Science & Technology

Subject Code: | Course Level:

L-T-P-C: 2-0-1-3 | Credit Units: 03

Course Objective:

To introduce the fundamental principles of seed biology, production, processing, testing, and storage, and their relevance in crop improvement and sustainable agriculture.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Statement	BT Level
CO1	Understand the basic concepts of seed structure, development, and dormancy.	BT-2
CO2	Identify and classify different types of seeds and their quality parameters.	BT-3
CO3	Apply principles of seed production, processing, and testing.	BT-4
CO4	Analyze factors affecting seed viability, vigor, and storability.	BT-4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Seed Science and Technology** : Definition, Scope, and Importance; History of Seed Industry; Seed Structure and Function (Monocot & Dicot); Seed Development and Maturation; Apomixis and Polyembryony; Seed Dormancy and Germination Processes.	12
II	**Seed Production Principles** : Generations of Seeds (Nucleus, Breeder, Foundation, Certified, Truthfully Labelled); Principles	12

	of Quality Seed Production; Isolation Distance; Rouging; Seed Village Concept; Hybrid Seed Production Techniques.	
III	**Seed Processing and Testing** : Principles and Methods of Seed Drying; Seed Cleaning and Grading; Seed Treatment: Objectives and Methods; Seed Sampling; Purity Analysis; Germination Test; Viability Tests (e.g., Tetrazolium Test); Moisture Content Determination.	12
IV	**Seed Quality Control, Storage, and Legislation** : Seed Vigor and its Testing; Factors Affecting Seed Longevity; Seed Storage Principles (Short, Medium, Long term); Controlled Storage Environments; Seed Certification: Procedures and Standards; Seed Act and Rules; Intellectual Property Rights in relation to seeds.	12

Practicals:

1. Study of seed structure of monocot and dicot seeds.
2. Determination of physical purity of a given seed sample.
3. Conducting standard germination tests for different crop seeds.
4. Performing Tetrazolium (TZ) test for seed viability.
5. Determination of seed moisture content.
6. Demonstration of seed processing equipment (seed cleaner, grader).
7. Practice of different seed treatment methods.
8. Study of seed sampling techniques.
9. Visit to a seed processing plant and seed testing laboratory.

Textbooks:

1. Agrawal, R. L. (2018). *Seed Technology*. Oxford & IBH Publishing Co. Pvt. Ltd.
2. Copeland, L. O., & McDonald, M. B. (2001). *Principles of Seed Science and Technology*. Springer Science & Business Media.
3. Vanangamudi, K., Natarajan, N., & Umarani, R. (2006). *Advances in Seed Science and Technology*. Agrobios India.
4. Basra, A.S. (Ed.). (2006). *Handbook of Seed Science and Technology*. Haworth Press Inc.
5. Khare, D., & Bhale, M. S. (2014). *Seed Technology*. Scientific Publishers.
6. Tunwar, N. S., & Singh, S. V. (1988). *Indian Minimum Seed Certification Standards*. Central Seed Certification Board, Ministry of Agriculture, Govt. of India.

7. Kelly, A. F. (1988). *Seed Production of Agricultural Crops*. Longman Scientific & Technical.

Semester - VIII

MAJOR SUBJECT: Agriculture Waste Management

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the basic principles of agricultural waste management, its impact on the environment and human health, and to explore sustainable and economically viable strategies for waste utilization and disposal.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Course Outcome	BT Level
CO1	Understand the types, sources, and characteristics of agricultural wastes and their environmental impact.	BT-2
CO2	Identify and classify different agricultural waste management techniques and their principles.	BT-3
CO3	Apply principles of waste reduction, reuse, recycling, and energy recovery in agricultural settings.	BT-4
CO4	Analyze the techno-economic feasibility and policy aspects of agricultural waste management.	BT-4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Agricultural Waste:** Definition, scope, and importance of agricultural waste management. Types of agricultural wastes (crop residues, animal manure, agro-industrial by-products, food processing waste, pesticide containers). Sources and generation rates. Characteristics of agricultural wastes (physical, chemical, biological). Environmental and health impacts of improper waste management. Indian scenario of agricultural waste generation and management.	12
II	**Waste Collection, Storage, and Treatment Principles:** On-farm and off-farm waste collection and transportation. Principles of safe storage of agricultural wastes. Overview of physical, chemical, and biological treatment methods. Composting: principles, methods (windrow, vermicomposting, in-vessel), factors affecting, and quality of compost. Anaerobic Digestion: principles, biogas production, types of digesters, and slurry management.	12
III	**Resource Recovery and Value Addition from Agricultural Waste:** Technologies for resource recovery: animal feed from crop residues, mushroom cultivation, biochar production, biofuel (ethanol, biodiesel) production from agricultural biomass. Value addition to agro-industrial by-products (e.g., rice husk, bagasse, coir pith). Integrated waste management systems for farms. Circular economy concepts in agricultural waste.	12
IV	**Waste Utilization, Disposal, and Management Strategies:** Land application of agricultural wastes: benefits and risks. Incineration and gasification for energy recovery. Safe disposal methods for hazardous agricultural wastes (e.g., pesticide containers, veterinary waste). Policies, regulations, and economic incentives for agricultural waste management in India. Case studies of successful agricultural waste management models. Future trends and challenges.	12

Practicals:

9. Identification and characterization of different types of agricultural wastes.
10. Demonstration of different composting techniques (e.g., pit method, heap method).
11. Setting up a vermicomposting unit and monitoring its progress.
12. Visit to a biogas plant or demonstration of a small-scale biogas digester.
13. Analysis of compost/vermicompost quality parameters (pH, EC, NPK).
14. Preparation of animal feed blocks from crop residues.
15. Demonstration of biochar production from agricultural biomass.
16. Study of different methods for safe disposal of pesticide containers.

Textbooks:

9. Gaur, A.C. (2020). *Integrated Organic Farming*. Agrotech Publishing Academy.
10. Tchobanoglous, G., Theisen, H., & Vigil, S.A. (1993). *Integrated Solid Waste Management: Engineering Principles and Management Issues*.[1] McGraw-Hill.
11. Palaniappan, S.P., & Annadurai, K. (2018). *Organic Farming: Theory and Practice*. Scientific Publishers.
12. Bhide, A.D., & Shekdar, A.V. (2008). *Solid Waste Management in Developing Countries*. PIPS Technology.
13. Rynk, R. (Ed.). (1992). *On-Farm Composting Handbook*. Northeast Regional Agricultural Engineering Service.
14. Kalamdhad, A.S. (2015). *Composting of Agricultural and Municipal Solid Wastes*. Narosa Publishing House.
15. Pathak, H., & Kumar, P. (Eds.). (2019). *Agricultural Waste Management in India: Status, Issues and Policy Options*. ICAR-Indian Agricultural Research Institute.
16. Verma, L.R., & Karki, T.B. (Eds.). (2007). *Biotechnological Applications in Integrated Rural Development*. New India Publishing Agency.

MAJOR SUBJECT: Commercial Beekeeping

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the fundamental principles of apiculture and its relevance in crop production, ecosystem balance, and sustainable income generation through commercial beekeeping.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Course Outcome	BT Level
CO1	Explain the concepts of bee biology, behavior, and modern apicultural practices.	BT - 2
CO2	Identify and classify bee species, equipment, and floral resources for beekeeping.	BT - 3
CO2	Apply principles of apiary management, queen rearing, and honey extraction.	BT - 3
CO3	Analyze and manage bee diseases, pests, and product diversification for commercial viability.	BT - 4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Apiculture** Definition, Scope, and Importance of Beekeeping; History of Apiculture; Species of Honey Bees: Apis mellifera, Apis cerana indica, Apis dorsata, Apis florea, Trigona spp.; Social Organization of Bee Colony; Bee Anatomy and Physiology; Life Cycle of Honey Bee; Bee Communication (Bee Dance).	12
II	**Apiary Establishment and Management** Selection of Apiary Site; Beehive Types and Equipment: Modern Beehives (Langstroth, Newton), Smoker, Hive Tool, Protective Gear; Seasonal Management of Bee Colonies: Spring, Summer, Autumn, Winter Management; Swarm Control and Prevention; Uniting and Dividing Colonies; Feeding of Bees.	12

III	**Bee Flora, Pollination, and Queen Rearing** Major Bee Flora: Nectar and Pollen Sources; Bee Foraging Behavior; Role of Bees in Crop Pollination; Benefits of Bee Pollination; Queen Rearing: Principles and Methods (Doolittle method, Jenter kit); Queen Introduction and Management; Royal Jelly Production.	12
IV	**Bee Diseases, Pests, Products, and Commercial Beekeeping** Diseases of Honey Bees: Bacterial (American Foulbrood, European Foulbrood), Fungal (Chalkbrood, Stonebrood), Viral (Sacbrood), Protozoan (Nosema); Pests and Predators of Honey Bees: Wax Moths, Ants, Wasps, Birds, Mites (Varroa, Tracheal); Integrated Pest and Disease Management (IPDM) in Apiary; Bee Products: Honey, Beeswax, Pollen, Propolis, Royal Jelly, Bee Venom – Collection, Processing, and Value Addition; Economics of Commercial Beekeeping; Marketing and Export of Bee Products.	12

Practicals:

10. Identification of different honey bee species, castes, and developmental stages.
11. Study of beekeeping equipment and apiary layout.
12. Handling of bee colonies: opening, examining, and closing hives.
13. Demonstration of seasonal management practices in an apiary.
14. Methods of queen rearing and queen introduction.
15. Identification of common bee flora and assessment of foraging behavior.
16. Diagnosis and management strategies for common bee diseases and pests.
17. Honey extraction, processing, and quality testing.
18. Preparation of value-added bee products (e.g., beeswax candles, pollen pellets).
19. Visit to a commercial apiary and honey processing unit.

Textbooks:

8. Mishra, R.C. (2019). *Perspectives in Indian Apiculture*. Agrotech Publishing Academy.
9. Singh, S. (2018). *Beekeeping in India*. Indian Council of Agricultural Research (ICAR).
10. Graham, J.M. (Ed.). (2021). *The Hive and the Honey Bee (Revised Edition)*. Dadant & Sons.
11. Crane, E. (1999). *The World History of Beekeeping and Honey Hunting*. Routledge.
12. Abrol, D.P. (2013). *Bees and Beekeeping in India*. New India Publishing Agency.
13. Gupta, J.K., & Rana, B.S. (2020). *Modern Beekeeping: A Comprehensive Guide to*

Apiculture. New India Publishing Agency.
14. Partap, U., & Verma, L.R. (2005). *Asian Bees and Beekeeping: Progress in the New Century*. Bishen Singh Mahendra Pal Singh.
15. Sammataro, D., & Avitabile, A. (2011). *The Beekeeper's Handbook (4th Edition)*. Comstock Publishing Associates.

MAJOR SUBJECT: Commercial Horticulture

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To impart comprehensive knowledge on the principles and practices of commercial cultivation of horticultural crops, focusing on production technologies, protected cultivation, post-harvest management, and marketing for entrepreneurship development in the horticultural sector.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Course Outcome	BT - Level
CO1	Understand the scope, importance, and challenges of commercial horticulture.	BT - 2
CO2	Identify and classify commercial horticultural crops and their specific requirements.	BT - 3
CO3	Apply appropriate production, protection, and management techniques for horticultural crops.	BT - 4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Commercial Horticulture and Propagation:** Definition, Scope, and Importance of Commercial Horticulture; Status and Prospects in India; Challenges in Commercial Horticulture (Climate Change, Biotic and Abiotic Stresses, Market Linkages); Types of Commercial Horticultural Enterprises; Plant Propagation for Commercial Scale: Sexual and Asexual Propagation Methods; Commercial Plant Propagation Structures: Nursery, Greenhouses, Polyhouses – Types, Design, and Maintenance; Media and Containers for Propagation.	12
II	**Production Technology of Commercial Fruit and Plantation Crops:** Commercial Cultivation of Major Fruit Crops (e.g., Mango, Banana, Citrus, Guava, Papaya, Grapes); Commercial Cultivation of Major Plantation Crops (e.g., Coconut, Arecanut, Cashew, Coffee, Tea); Soil and Climatic Requirements; Improved Varieties and Hybrids; Planting Systems and Canopy Management; Water and Nutrient Management (Fertigation); Integrated Pest and Disease Management (IPDM); Use of Plant Growth Regulators; Harvesting and Yield.	12
III	**Production Technology of Commercial Vegetable and Flower Crops:** Commercial Cultivation of Major Vegetable Crops (e.g., Tomato, Brinjal, Chili, Okra, Cole Crops, Cucurbits); Commercial Cultivation of Major Flower Crops (e.g., Rose, Chrysanthemum, Marigold, Jasmine, Gerbera, Anthurium); Protected Cultivation of High-Value Vegetables and Flowers: Hydroponics, Aeroponics, Vertical Farming (Basic Concepts); Off-season Cultivation; Integrated Pest and Disease Management (IPDM); Weed Management; Harvesting, Grading, and Yield.	12

IV	**Post-Harvest Management, Value Addition, and Marketing of Horticultural Produce:** Importance of Post-Harvest Technology; Factors Affecting Post-Harvest Life; Pre-cooling, Cleaning, Grading, and Packaging; Storage Methods (Cold Storage, Controlled Atmosphere Storage); Value Addition in Horticultural Crops (Juices, Jams, Jellies, Pickles, Dehydrated Products, Essential Oils); Quality Standards and Certification; Supply Chain Management; Marketing Channels, Market Intelligence, Export Potential and Procedures; Government Schemes and Policies for Promoting Commercial Horticulture.	12

Practicals:

9. Identification of commercially important horticultural crops and their varieties.
10. Demonstration of different methods of plant propagation (cutting, grafting, budding, layering).
11. Preparation of nursery beds and potting mixtures.
12. Layout and planting of a model orchard/vegetable farm.
13. Training and pruning techniques in fruit crops.
14. Fertigation scheduling and application.
15. Identification of common pests, diseases, and physiological disorders in horticultural crops and their management.
16. Visit to commercial nurseries, orchards, vegetable farms, and protected cultivation units.
17. Demonstration of harvesting, grading, and packaging techniques for horticultural produce.
18. Preparation of value-added products (e.g., jam, squash).
19. Study of marketing channels and project preparation for a small commercial horticulture unit.

Textbooks:

1. Chadha, K.L. (2019). *Handbook of Horticulture*. Indian Council of Agricultural Research, New Delhi.
2. Singh, Jitendra. (2020). *Fundamentals of Horticulture*. Kalyani Publishers, Ludhiana.
3. Patel, N.L., Chawla, S.L., & Ahlawat, T.R. (2015). *Commercial Horticulture*. New India Publishing Agency, New Delhi.
4. Bose, T.K., Mitra, S.K., & Sanyal, D. (Eds.). (2001). *Fruits: Tropical and Subtropical (Vols. 1 & 2)*. Naya Udyog, Kolkata.
5. Bose, T.K., Kabir, J., Das, P., & Joy, P.P. (Eds.). (2002). *Tropical Horticulture (Vol. 1 & 2)*. Naya Prokash, Kolkata.
6. Lauria, Alex & Ries, Victor H. (2002). *Floriculture: Fundamentals and Practices*. Agrobios

(India).
7. Srivastava, R.P. & Kumar, Sanjeev. (2006). *Fruit and Vegetable Preservation: Principles and Practices*. International Book Distributing Co.
8. Singh, S.P. (Ed.). (2005). *Commercial Floriculture*. New Age International Publishers.

MAJOR SUBJECT: Seed Production and Technology

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the fundamental principles of seed production, processing, testing, and storage, and to highlight its significance in crop improvement, agricultural productivity, and the seed industry.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	**Course Outcome**	**BT Level**
CO1	Understand the principles of seed biology, seed quality, and classes of seeds.	BT-2
CO2	Apply appropriate techniques for seed production of various crop groups.	BT-3
CO3	Analyze procedures for seed processing, testing, treatment, and storage to maintain quality.	BT-4
CO4	Evaluate seed certification systems, legislative frameworks, and the role of the seed industry.	BT-5

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**

I	**Fundamentals of Seed and Seed Quality:** Seed and its importance; Seed vs. Grain. Seed Biology: Structure of monocot and dicot seeds; Seed development and maturation; Chemical composition of seeds. Germination: Physiological and biochemical changes during germination; Factors affecting germination. Seed Dormancy: Types, causes, and methods to overcome dormancy. Seed Quality: Concept and characters of good quality seed; Classes of Seed: Nucleus, Breeder, Foundation, Certified, and Truthfully Labelled seeds; Generation system of seed multiplication.	12
II	**Principles and Methods of Seed Production** General Principles of Seed Production: Choice of agro-climatic conditions; Selection of site; Isolation requirements; Rouging; Nutrition and irrigation management; Weed control specific to seed crops. Seed Production Techniques for major field crops: - Self-pollinated crops (e.g., Rice, Wheat) - Cross-pollinated crops (e.g., Maize, Sunflower) - Often cross-pollinated crops (e.g., Cotton, Sorghum) Hybrid Seed Production: Principles; Methods of hybrid seed production (e.g., hand emasculation and pollination, use of male sterility systems, self-incompatibility). Maintenance of genetic purity during seed production.	12
III	**Seed Processing, Testing, and Treatment** Seed Harvesting and Threshing: Maturity indices; Methods of harvesting and threshing for different crops. Seed Drying: Principles and methods of seed drying. Seed Processing: Principles and operations - cleaning, grading, upgrading; Seed processing equipment. Seed Testing: Objectives; International Seed Testing Association (ISTA) and its role. - Sampling: Methods and sample size. - Purity Analysis: Physical and genetic purity. - Moisture Test: Importance and methods. - Germination Test: Requirements and procedures. - Viability Tests: Tetrazolium (TZ) test. - Seed Vigour Tests: Concept and methods. Seed Health Testing: Detection of seed-borne diseases and pests. Seed Treatment: Objectives, types, benefits, and methods of application; Seed coating and pelleting.	12

IV	**Seed Storage, Certification, Legislation, and Industry** Seed Storage: Factors affecting seed longevity in storage; Controlled storage conditions; Seed packaging materials and methods; Different types of storage structures. Seed Deterioration: Causes (physiological, biochemical, pathological) and control measures. Seed Certification: Objectives, concept, and organization; Phases of seed certification (field inspection, pre and post-harvest inspection, seed sampling and testing); Minimum seed certification standards; Grow-out test. Seed Legislation and Policies: Indian Seed Act (1966) and Rules (1968); National Seed Policy (2002); Plant Variety Protection and Farmers' Rights (PVPFR) Act (2001); OECD Seed Schemes.	12

Practicals:

10. Study of seed structure in monocotyledonous and dicotyledonous crops.
11. Identification of seeds of major crops.
12. Demonstration of seed sampling procedures and obtaining a working sample.
13. Determination of physical purity of a given seed sample.
14. Determination of seed moisture content using a hot air oven method.
15. Conducting a standard germination test for a given crop.
16. Seed viability testing using the Tetrazolium (TZ) test.
17. Demonstration of different methods to break seed dormancy.
18. Study of hybrid seed production techniques (e.g., emasculation and pollination in selected crops).
19. Visit to a local seed processing unit and a seed testing laboratory.
20. Calculation of seed rate and assessment of seed quality parameters from a given sample.
21. Study of different seed treating chemicals and methods of seed treatment.

Textbooks:

8. Agrawal, R.L. (2018). *Seed Technology*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Tunwar, N.S., & Singh, S.V. (1988). *Indian Minimum Seed Certification Standards*. Central Seed Certification Board, Ministry of Agriculture, Govt. of India, New Delhi.
10. Copeland, L.O., & McDonald, M.B. (2004). *Principles of Seed Science and Technology*. Kluwer Academic Publishers.
11. Khare, D., & Bhale, M.S. (2014). *Seed Technology*. Scientific Publishers, Jodhpur.
12. Basra, A.S. (Ed.). (2006). *Handbook of Seed Science and Technology*. Haworth Press Inc., New York.
13. Vanangamudi, K., Natarajan, N., Srimathi, P., Umarani, R., & Natesan, P. (2006). *Advances*

in Seed Science and Technology. Agrobios India.
14. Kelly, A.F., & George, R.A.T. (1998). *Encyclopaedia of Seed Production of World Crops*. John Wiley & Sons.
15. Chhabra, A.K. (2006). *Practical Manual on Seed Production and Technology*. Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar.

MAJOR SUBJECT: Commercial Sericulture

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the fundamental principles of sericulture and its significance in commercial agro-based industry, encompassing mulberry cultivation, silkworm rearing, and post-cocoon technology.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Course Outcome	BT Level
CO1	Understand the fundamentals and scope of sericulture.	BT - 2
CO2	Identify silkworm types, host plants, and mulberry varieties.	BT - 3
CO3	Apply management practices for mulberry cultivation and silkworm rearing.	BT - 4
CO4	Analyze post-cocoon technologies and sericulture economics.	BT - 4

Detailed Syllabus

Module	Course Content	Lectur e Hours
I	**Fundamentals of Sericulture** Definition, Scope, and Importance of Sericulture; History and Development of Sericulture in India and globally; Types of Silkworms (Mulberry, Tasar, Eri, Muga) and their host plants; Life Cycle of Mulberry Silkworm (*Bombyx mori*); Morphology and Anatomy of Silkworm.	12
II	**Mulberry Cultivation and Management** Soil and Climatic Requirements for Mulberry; Recommended Mulberry Varieties; Propagation Techniques (Seed, Cutting, Grafting); Mulberry Orchard Establishment and Management; Irrigation and Nutrient Management for Mulberry; Pests and Diseases of Mulberry and their control; Leaf Harvesting and Preservation.	12
III	**Silkworm Rearing and Cocoon Production** Rearing House: Location, Orientation, and Disinfection; Rearing Appliances; Incubation of Silkworm Eggs; Chawki Rearing: Techniques and Importance; Late Age Silkworm Rearing; Environmental Requirements for Silkworm Rearing; Nutrient Requirements of Silkworm; Diseases and Pests of Silkworms and their Management; Mounting and Harvesting of Cocoons; Cocoon Assessment and Sorting.	12
IV	**Post-Cocoon Technology and Sericulture Economics** Cocoon Marketing; Cocoon Stifling, Sorting, and Grading; Reeling: Principles and Methods (Charkha, Cottage Basin, Multi-end); Raw Silk Testing and Grading; By-products of Sericulture and their Utilization; Economics of Mulberry Cultivation and Silkworm Rearing; Role of Government Agencies and Schemes in Sericulture Development; Value Addition in Sericulture.	12

Practicals:

1. Identification of different types of silkworms and their host plants.
2. Study of the life cycle of the mulberry silkworm.
3. Morphological study of mulberry silkworm larvae, pupa, and adult.
4. Demonstration of mulberry propagation techniques.
5. Identification of common pests and diseases of mulberry and their control measures.
6. Study of rearing house plan and disinfection methods.
7. Demonstration of chawki rearing and late-age silkworm rearing techniques.
8. Identification of common silkworm diseases and pests and their management.
9. Demonstration of mounting and cocoon harvesting.
10. Study of cocoon stifling and reeling processes.
11. Calculation of economics of mulberry cultivation and silkworm rearing.

Textbooks:

1. Ganga, G. & Chetty, J.S. (2008). *An Introduction to Sericulture*. Oxford & IBH Publishing Co. Pvt. Ltd.
2. Ullal, S.R. & Narasimhanna, M.N. (1987). *Handbook of Practical Sericulture*. Central Silk Board, Bangalore.
3. Sarkar, D.C. (1988). *Eri Silk Industry*. Central Silk Board, Bangalore.
4. Krishnaswami, S. (1978). *New Technology of Silkworm Rearing*. Central Silk Board, Bangalore.
5. Dandin, S.B., Jayant Jayaswal, & Giridhar, K. (2003). *Handbook of Sericulture Technologies*. Central Silk Board, Bangalore.
6. Madhu, R. (2016). *Textbook on Tropical Sericulture*. Kalyani Publishers.
7. FAO. (1991). *Silkworm Rearing*. Food and Agriculture Organization of the United Nations.

MAJOR SUBJECT: Production Technology for Bioagents and Biofertilizer

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To impart knowledge and practical skills on the production technology of bioagents and biofertilizers, their quality control, and their role in sustainable agriculture.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	Statement	BT Level
CO1	Understand the concepts, types, and importance of bioagents and biofertilizers.	BT - 2
CO2	Describe the production techniques for various biofertilizers and bioagents.	BT - 3
CO3	Apply quality control measures and understand the application of these beneficial microbes.	BT - 4

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Biofertilizers and Bioagents:** Definition, scope, and importance in sustainable agriculture; Types of biofertilizers (Nitrogen fixers: Rhizobium, Azotobacter, Azospirillum, BGA, Azolla; Phosphate solubilizers/mobilizers: PSB, VAM); Types of bioagents/biopesticides (microbial: viruses, bacteria, fungi, protozoa; botanicals); Advantages and constraints.	12
II	**Mass Production of Biofertilizers:** Isolation, characterization, and maintenance of mother cultures; Media preparation, sterilization; Mass multiplication techniques for Rhizobium, Azotobacter, Azospirillum, PSB, and VAM; Carrier materials, formulation, packing, and storage.	12
III	**Mass Production of Bioagents:** Isolation, identification, and culture of common entomopathogenic fungi (e.g., *Metarhizium*, *Beauveria*, *Verticillium*), bacteria (e.g., *Bacillus thuringiensis*), and	12

	viruses (e.g., NPV); Production of antagonists (e.g., *Trichoderma*, *Pseudomonas fluorescens*); Techniques for mass multiplication, formulation, and storage.	
IV	**Quality Control, Application, and Entrepreneurship:** Quality control standards and testing procedures for biofertilizers and bioagents; CFU count, contamination tests, bioefficacy; Methods of application (seed treatment, soil application, foliar spray); Integration with INM & IPM; Entrepreneurial opportunities in bioagent and biofertilizer production; Registration and legal aspects.	12

Practicals:

1. Isolation and purification of Rhizobium from root nodules.
2. Isolation and purification of Azotobacter and PSB from soil.
3. Mass multiplication of Rhizobium and Azotobacter.
4. Observation of VAM fungi in roots.
5. Isolation and identification of *Trichoderma* spp. from soil.
6. Mass multiplication of *Trichoderma* spp. on solid and liquid substrates.
7. Testing the quality of biofertilizers (CFU count).
8. Formulation and packaging of biofertilizers and bioagents.
9. Field visit to a commercial biofertilizer/bioagent production unit.

Textbooks:

1. Subba Rao, N.S. (2018). *Biofertilizers in Agriculture and Forestry*. Medtech.
2. Kannaiyan, S. (2002). *Bioetchnology of Biofertilizers*. Alpha Science International Ltd.
3. Reddy, P. Parvatha. (2015). *Recent Advances in Biofertilizers and Biofungicides (Biopesticides) for Sustainable Agriculture*. Springer.
4. Arora, D.K., Elander, R.P., & Mukerji, K.G. (Eds.). (1992). *Handbook of Applied Mycology: Volume 4: Fungal Biotechnology*. CRC Press.
5. Upadhyay, R. K., Mukerji, K. G., & Chamola, B. P. (Eds.). (2000). *Biocontrol Potential and its Exploitation in Sustainable Agriculture: Volume 1: Crop Diseases, Weeds and Nematodes*.[1] Springer Science & Business Media.
6. Mishra, S.P. (2021). *Biofertilizers and Biopesticides in Sustainable Agriculture*. NIPA GENX Electronic Resources & Solutions Pvt. Ltd.
7. Saxena, A.K., & Tilak, K.V.B.R. (Eds.). (2006). *Biofertilizers for Sustainable Agriculture*. Scientific Publishers.
8. Burges, H.D. (Ed.). (1998). *Formulation of Microbial Biopesticides: Beneficial*

Microorganisms, Nematodes and Seed Treatments. Springer Science & Business Media.

MAJOR SUBJECT: Nanobiotechnology

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the fundamental principles of nanobiotechnology and its applications in enhancing agricultural productivity, sustainability, and food security.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	**Course Outcome**	**BT Level**
CO1	Understand the basic concepts and scope of nanobiotechnology in agriculture.	BT-2
CO2	Identify and classify nanomaterials and their applications relevant to agricultural systems.	BT-3
CO3	Apply principles of nanobiotechnology for crop improvement, pest management, and nutrient delivery.	BT-4

Detailed Syllabus

Module	**Course Content**	**Lecture Hours**
I	**Fundamentals of Nanobiotechnology:** Definition, Scope, and Importance: Nanotechnology, Bionanotechnology, Nanobiotechnology in Agriculture; Relationship with Other	12

	Sciences: Interface of nanotechnology with biology, chemistry, physics, and agricultural sciences; Nanomaterials: Classification (0D, 1D, 2D, 3D), types (nanoparticles, nanotubes, nanofibers, quantum dots, nanocomposites); Synthesis of Nanomaterials: Top-down and Bottom-up approaches; Physical, Chemical, and Biological (Green) synthesis methods; Characterization Techniques for Nanomaterials: Microscopy (SEM, TEM, AFM), Spectroscopy (UV-Vis, FTIR, DLS).	
II	**Nanomaterials in Agriculture:** Nanofertilizers: Concepts, types (macronutrient and micronutrient nanofertilizers), controlled release mechanisms, benefits and limitations; Nanopesticides: Nanoherbicides, Nanoinsecticides, Nanofungicides; Targeted delivery, enhanced efficacy, reduced environmental impact; Nanosensors for Agriculture: Detection of soil nutrients, plant pathogens, pesticides, and environmental contaminants; Nanomaterials for Soil Health Management: Soil remediation, improving soil structure and water retention.	12
III	**Applications of Nanobiotechnology in Crop Improvement and Protection:** Genetic Engineering and Nanotechnology: Nanocarriers for gene delivery in plants, targeted genetic modification; Plant Disease Diagnostics: Rapid and sensitive detection of plant pathogens using nanobiosensors; Nanotechnology in Seed Science: Seed coating with nanomaterials for enhanced germination and seedling vigor; Smart Delivery Systems: Encapsulation and targeted delivery of agrochemicals (pesticides, fertilizers, growth regulators); Nanopriming and Nanostimulants: Enhancing plant stress tolerance (drought, salinity, heat).	12
IV	**Nanobiotechnology for Sustainable Agriculture and Food Systems:** Water Purification and Management: Nanomembranes and nanocatalysts for water treatment in agriculture; Food Processing and Packaging: Nanoemulsions, nanocomposite films for enhanced food quality, safety, and shelf-life; Nanotoxicity and Ecotoxicology: Potential risks of nanomaterials to soil, water, plants, and human health; Regulatory Aspects and Ethical	12

	Considerations: Guidelines for the safe use of nanotechnology in agriculture and food; Future Prospects: Emerging trends and challenges in agricultural nanobiotechnology.	

Practicals:

1. Introduction to laboratory safety and good laboratory practices in nanobiotechnology.
2. Green synthesis of nanoparticles (e.g., silver or zinc oxide nanoparticles using plant extracts).
3. Characterization of synthesized nanoparticles using UV-Vis spectrophotometry.
4. Study of the effect of nanofertilizers on seed germination and seedling growth (pot experiment).
5. Demonstration of nanopesticide formulation (if feasible and safe).
6. Preparation of nanoemulsions for potential agrochemical delivery.
7. Assessment of antimicrobial activity of nanoparticles against common plant pathogens (demonstration or in-vitro).
8. Literature survey and presentation on a specific application of nanobiotechnology in agriculture.

Textbooks:

1. Prasad, R., & Kumar, V. (Eds.). (2017). *Nanotechnology in Agri-Food Systems*. Springer.
2. Rai, M., & Ingle, A. (Eds.). (2019). *Nanotechnology for Agriculture: Crop Production and Protection*. Springer.
3. Fraceto, L. F., Grillo, R., & de Lima, R. (Eds.). (2020). *Nanoparticles in Agrobiology: Function and Applications*. Springer.
4. Servin, A. D., & White, J. C. (Eds.). (2016). *Nanotechnology and the Agri-Food Sector: Implications for the Future of the Food Supply Chain*. Springer.
5. Dutta, J., & Hofmann, H. (2019). *Nanomaterials for Agriculture and Water Treatment*. Wiley-VCH.
6. Siddiqui, M.H., Al-Whaibi, M.H., & Mohammad, F. (Eds.). (2015). *Nanotechnology and Plant Sciences: Nanoparticles and Their Impact[1] on Plants*. Springer.
7. Ghorbanpour, M., & Varma, A. (Eds.). (2017). *Nanoscience and Plant–Soil Systems*. Springer.

MAJOR SUBJECT: Food Processing

Subject Code: | Course Level:

L-T-P-C: 3-0-1-4 | Credit Units: 04

Course Objective:

To introduce the fundamental principles of food processing and preservation techniques. This course aims to provide students with knowledge of various methods used to transform raw agricultural produce into safe, edible, and marketable food products, thereby extending shelf life, enhancing quality, and reducing post-harvest losses.

Course Outcome:

On successful completion of the course, the student will be able to:

CO	**Course Outcome**	**BT Level**
CO1	Understand the basic concepts, scope, and importance of food processing and preservation.	BT-2
CO2	Identify and classify various food processing and preservation methods.	BT-3
CO3	Apply principles of food processing techniques to different food commodities.	BT-3
CO4	Analyze the effects of processing on the nutritional quality and safety of food products.	BT-4
CO5	Understand the principles of food packaging and quality control in food processing industries.	BT-2

Detailed Syllabus

Module	Course Content	Lecture Hours
I	**Introduction to Food Processing:** Definition, Scope, and Importance of Food Processing; Historical Development of Food Processing; Classification of Foods by Perishability and Processing Required; Current Status and Future Prospects of Food Processing Industry in India; Principles of Food Preservation.	12
II	**Processing of Agricultural Produce – I (Cereals, Pulses, Oilseeds):** Milling of Wheat: Atta, Maida, Suji; Rice Milling: Parboiling; Corn Milling: Wet and Dry Milling; Pulse Processing: Dehulling, Splitting, Puffing; Oil Extraction Methods: Mechanical Pressing, Solvent Extraction; Refining of Oils. Introduction to Bakery and Confectionery Products.	12
III	**Processing of Agricultural Produce – II (Fruits, Vegetables, Milk, Meat, Fish):** Fruits and Vegetables Processing: Juices, Squashes, Ketchups, Sauces, Pickles, Jams, Jellies, Marmalades; Canning and Bottling; Dehydration and Drying Methods; Minimal Processing. Milk Processing: Pasteurization, Homogenization, Sterilization; Indigenous Milk Products. Basic Meat and Fish Processing: Chilling, Freezing, Salting, Smoking.	12
IV	**Food Preservation, Packaging, and Quality Control:** Preservation by High Temperature (Sterilization, Pasteurization), Low Temperature (Refrigeration, Freezing); Preservation by Drying, Osmotic Pressure (Sugar and Salt), Chemical Preservatives, Fermentation, Irradiation. Food Packaging: Objectives, Materials, Techniques (Vacuum Packaging, Modified Atmosphere Packaging). Basic Concepts of Food Safety, HACCP, FSSAI standards; Quality Control in Food Processing.	12

Practicals:

1. Familiarization with equipment used in food processing.

2. Determination of moisture content in food samples.
3. Estimation of acidity and pH in food products.
4. Preparation of fruit juices and squashes.
5. Preparation of jam/jelly.
6. Preparation of tomato ketchup/sauce.
7. Demonstration of drying and dehydration of fruits and vegetables.
8. Quality evaluation of milk (COB, MBRT).
9. Visit to a local food processing unit/industry.

Textbooks:

1. Srivastava, R.P. and Kumar, S. (2019). *Fruit and Vegetable Preservation: Principles and Practices*. International Book Distributing Co.
2. Khetarpaul, N. (2009). *Food Processing and Preservation*. Daya Publishing House.
3. Fellows, P.J. (2017). *Food Processing Technology: Principles and Practice* (4th ed.). Woodhead Publishing.
4. Potter, N.N. and Hotchkiss, J.H. (1995). *Food Science* (5th ed.). CBS Publishers & Distributors.
5. Manay, N.S. and Shadaksharaswamy, M. (2005). *Foods: Facts and Principles*. New Age International (P) Ltd.
6. Desrosier, N.W. and Desrosier, J.N. (1998). *The Technology of Food Preservation* (4th ed.). CBS Publishers & Distributors.
7. Sharma, A. (2011). *Textbook of Food Science and Technology*. Vista International Publishing House.
8. Ranganna, S. (2014). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (2nd ed.). Tata McGraw-Hill Education.