B.Sc. (HONS.) AGRICULTURE

PROGRAM SYLLABUS (EMBEDDED WITH COs)

School of Agriculture,

ITM University, Gwalior, Madhya Pradesh 474001

SYLLABUS

WITH

EMBEDDED

COURSE OUTCOMES (COs)

I SEMESTER

Course Code: HORT-111	Course Name: Fundamentals of Horticulture	Semester: I

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Ag)**
Curriculum level							Basic and applied	**Student specific course outcome**	Placement Research Entrepreneurship Higher education

Objective: To provide hands on training on various propagation methods and important cultural practices for major fruit and plantation crops.

Course outcomes: Through this course students will be able to:

CO-1	Describe the scope and importance of horticulture along with the basic principles and concepts of orchard establishment, production and management of horticultural crops
CO-2	Explain the suitability of horticultural crops under different agro-climatic conditions along with their suitable propagation techniques and management practices
CO-3	Demonstrate various techniques and practices of horticultural crops production and management in the field
CO-4	Analyse the significance of various propagation techniques and intercultural operations and management practices used in different horticultural crops
CO-5	Evaluate the role of various factors affecting the growth and development and sustainable production horticultural crops

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz

AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit – 1** Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification;	Presentation
	Climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination,	Mid Term examination Report writing
	Unit – 3 principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation;	Assignment Field trial
	Unit – 4 unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants;	ABL Quiz
	Unit-V Importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.	End term examination ABL

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Identification of garden tools 2. Identification of horticultural crops. 3. Preparation of seed bed/nursery bed. 4. Practice of sexual and asexual methods of propagation 5. Layout and planting of orchard 6. Training and pruning of fruit trees 7. Preparation of potting mixture	Practical Activity Practical Record Viva voce Spot Identification

	8. Fertilizer application in different crops 9. Visits to commercial nurseries/orchard	
Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Status of horticultural crops area and production in different states of India 2. Varietal health of horticultural crops	
Suggested reading:	**A. Textbooks:** 1. Jitendra Singh, 2012. Basic Horticulture. Kalyani Publishers. New Delhi. 2. Kumar, N. 1997. Introduction to Horticulture. Rajyalakshmi Publications, Nagorcoil, Tamilnadu. 3. Randhawa, G.S. and Mukhopadhyaya, A. 1994. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi **B. Reference books:** 1. Chadha, K.L. 2019. Handbook of Horticulture (Vol-I & II). ICAR, New Delhi. 2. Advances in Horticulture. 2002. K. L. Chadha, O. P. Pareek, P. Rethinam. Malhotra Publishing House, New Delhi	
Suggested e-resources (Websites/e-books)	1.http://agricoop.gov.in/Documents/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf 2.http://agricoop.gov.in/en/StatHortEst#gsc.tab=0 3. https://agriexchange.apeda.gov.in/indexp/genReport_combined.aspx#content	

Course Code: BIOCHEM BT-111	**Course Name:** Fundamentals of Plant Biochemistry and Biotechnology	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hos (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. Ag.**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Higher education • Research

Objective: This course covers the physiological mechanisms of growth, flowering, and development of fruits and seeds, as well as the mechanisms of abscission, senescence, and fruit ripening. Also deals with existence of organ forming substances, moving in various pollar patterns and controlling growth and development in horticultural crop plants.

Course outcomes: Through this course students will be able to:

CO-1	Describe the role and importance of various biomolecules in sustaining the life
CO-2	Explain the metabolic processes involving different bio-molecules
CO-3	Apply the various concepts biotechnology in crop plant improvement
CO-4	Analyse the different biomolecules in agricultural samples using different biochemical techniques
CO-5	Evaluate the role of biomolecules in affecting the nutritional quality and productivity of agricultural crops

Teaching Pedagogy:

T1	Classroom Teaching (Chalk-board) Power Point Presentations
T2	Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Assignment
AT1-2	Quiz
AT1-3	Mid Term Exams
AT1-4	End Term Exam

AT1-5	Report Writing
AT1-6	Activity Based Learning
AT1-7	Viva Voce Examination

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain.	Assignment
	Unit – 2 Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.	Assignments Mid Term Examination
	Unit – 3 Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.	Quiz
	Unit – 4 Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation.	Activity Based Learning Flip Class/ Seminars Quiz
	Unit-V Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; Molecular Markers and their classification RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.	Flip Class/ Seminars Assignments End Term Examination

Practical Exercise*	Course Modules	Assessment tools
	1. Study of safety measures and Laboratory Instruments 2. Preparation of Solution 3. Qualitative Analysis of Carbohydrates 4. Qualitative analysis of Protein 5. Qualitative Analysis of Lipids 6. Study of Sterilization Techniques 7. Study of composition of various tissue culture media 8. Demonstration on isolation of DNA. 9. Demonstration of gel electrophoresis techniques	Practical Activity Practical Record Practical and Viva voce Examination
Suggested reading:	1. Nelson DL & Cox MM. 2004. Lehninger's Principles of Biochemistry. MacMillan. 2. Voet D & Voet JG. Biochemistry. 3rd Ed. Wiley International 3. Satyanarayana U,Textbook of biochemistry,2007, 3rd edition, Books and Allied (P) ltd, Kolkata. 4. D T Plummer, An Introduction to Practical Biochemistry, 1987, 3rd edition,McGraw-Hill, USA. 5. S. Sadasivam and A. Manickam, "Biochemical Methods," New Age International (P) Limited, New Delhi, Vol. 2. 1996, pp. 124-126. 6. B. D. Singh, Biotechnology Expanding Horizons	
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Importance of Biochemistry in Agriculture 2. Transgenics and its importance in crop improvement 3. Biotechnology regulations in India	

Course Code: SS-111	Course Name: Fundamental of soil science	Semester: I

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1				3		B.Sc. Ag.
Curriculum level							• Information based • Research based	Student specific course outcome	• Research • Higher education • Higher education

Objective: To provide the student with a formalized way to build their fundamental knowledge and skills within the different areas of soil

Course outcomes: Through this course students will be able to:

CO-1	Describe the basic concepts and principles of Soil Science
CO-2	Explain the behaviour of various soils in relation to crop production and management
CO-3	Demonstrate various soil physical, chemical and biological properties and their impact on plant growth
CO-4	Examine the soil pollution and its prevention
CO-5	Evaluate the harmful effects of various agrochemicals on soil health

Teaching Pedagogy:

T1	Class room teaching, Lab Experiments (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation and Report
AT1-3	Quiz
AT1-4	Poster

AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field Visit Report
AT1-9	Assignment

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit-I:** Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation	Assignment Poster
	Unit-II: Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity	Mid Term examination Field visit
	Unit-III: Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth	Class room teaching (Chalk-board) Presentation
	Unit-IV: Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation.	Class room teaching (Chalk-board) ABL Quiz
	Unit-V: Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro-organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Study of soil profile in field.	Practical Activity

	2. Study of soil sampling tools, collection of representative soil sample, its processing and storage 3. Determination of soil colour. 4. Determination of soil pH and electrical conductivity. 5. Determination of soil texture by feel and Bouyoucos Methods. 6. Determination of Bulk density & Particle density 7. Determination of moisture content and porosity 8. Determination of soil organic carbon. 9. Estimation of organic matter content of soil. 10. Demonstration of heat transfer in soil.	Practical Record Viva voce Spot Identification Field Visit
Resources:	LCD, OHP, Black Board, Soil science Lab.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. soil taxonomy classification Study about different physical properties of soil	
Suggested reading:	1. *Fundamental of soil science-V.N.Sahai* 2. *Nature & properties of soils-H.O. Buckman & N.C. Brady* 3. *Introduction of soil science- Dilip Kumar Das* 4. *Textbook of soil science- R.K.Mehra* 5. *Fundamental of Soil science-Indian society of soil science, IARI, New Delhi* .	
Suggested e-resources (Websites/e-books)	http://ecoursesonline.iasri.res.in/course/view.php?id=125	

Course Code: AGRON -111	**Course Name:** Fundamentals of Agronomy	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
4	3	0	1				5		**B.Sc. (Ag)/AGRON**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective:

1. To understand the basic concepts and components of Agronomy
2. To Understand various agronomic terms
3. To have hands on experience of the basic agronomic practices

Course outcomes: Through this course students will be able to:

CO-1	Define the importance and scope of agronomy in relation to agricultural crop production
CO-2	Explain various types of agricultural inputs, which required for crop cultivation
CO-3	Calculate the required amount/number of various crop production factors (*i.e.,* seed rate, fertilizers, agrochemicals, plant population) for specific land area
CO-4	Analyse the role of various intercultural operations with reference to crop yield and its contributing traits
C0-5	Evaluate the effect of various production factors on overall crop production

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz Field visit

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency,	Assignment
	Unit – 2 water resources, soil plant water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging.	Mid Term examination Report writing
	Unit – 3 Weeds- importance, classification, crop weed competition, concepts of weed management principles and methods, herbicides-classification, selectivity and resistance, allelopathy.	Field trial Presentation
	Unit – 4 Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.	ABL Quiz

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	10. Identification of crops, seeds, fertilizers, pesticides and tillage implements, 11. Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, 12. Seed germination and viability test, 13. Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, 14. Study of soil moisture measuring devices, 15. Measurement of field capacity, bulk density and infiltration rate,	Practical Practical Record Viva voce Practical
Resources:	LCD, OHP, Black Board,field	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	3. Water harvesting Soil moisture conservation	
Suggested reading:	1. Handbook of Agriculture, ICAR, New Delhi 2. Reddy, S.R. 2016. Principles of Agronomy. Kalyani Publishers, Ludhiana, 5th Edition. 3. Yellamanda Reddy, T. and SankaraReddi, G.H. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana. Gopal Chandra De. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co. Pvt. Ltd.,	
Suggested e-resources (Websites/e-books)	1. https://naarm.org.in/wp-content/uploads/2020/06/ICAR-NAARM-Policy-on-Climate-Change-and-Agriculture_compressed.pdf 2. https://icar.org.in/Indian-Agriculture-after-Independence.pdf	

Course Code: AGRON-113	Course Name: Introduction to Forestry	Semester: I

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Hon's), Agriculture**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective: To provide knowledge about silviculture operations, forest inventory and different agroforestry systems and hands on training on important cultivation practices for fast growing tree species.

Course outcomes: Through this course students will be able to:

CO-1	Describe the basic concept of forestry and important features Indian Forest Policy
CO-2	Classify the Indian forest with their specific features and ecological regions
CO-3	Calculate the various parameters of forest
CO-4	Examine the different agroforestry systems prevalent in the country
CO-5	Determine the suitability of tree species for different regions based on soil and climatic conditions

Teaching Pedagogy:

T1	Activity based learning through Field / Lab experimentation Power Point Presentations
T2	ABL activities Assignments Seminar Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Activity Based Learning
AT1-4	Quiz
AT1-5	Viva voce examination

AT1-6	Field visit
AT1-7	Spot Identification

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies;	Class room teaching ABL
	Unit – 2 Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification	Mid Term examination
	Unit – 3 Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. ;	Quiz
	Unit – 4 Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement – shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees ;	Presentation ABL through Field experimentation
	Unit-V Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.	Assignment Viva Voce End term examination

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Identification of tree-species 2. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. 3. Height measurement of standing trees by shadow method, single pole method and hypsometer. 4. Volume measurement of logs using various formulae	Practical Activity Practical Record Viva voce Spot Identification

	5. Nursery lay out, seed sowing, vegetative propagation techniques Training and pruning of fruit trees 6. Forest plantations and their management 7. Fertilizer application in different crops 8. Visits of nearby forest based industries	
Resources:	LCD, Black Board, Agroforestry Laboratory, Field, Instruments.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Cultivation practices of two important fast growing tree species of the region. 2. Different agroforestry systems prevalent in the country	
Suggested reading:	**Textbooks:** **A.** Reddy, S.R., Nagamani, C., 2019. Introduction to Forestry. Kalyani Publishers. New Delhi. **B.** Kumar, V., 2018. Nursery and Plantation practices in Forestry. Scientific Publisher. Jodhpur. **C.** Dwivedi.A.P. 1993.Textbook of Silviculture. International Book Distributors. **D.** Khanna, L.S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi, 473p. **E.** Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, The Netherlands. **Reference books:** **F.** Manikandan, K., Prabhu, S., 2010. Indian Forestry. Jain Brothers, New Delhi. **G.** Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). KhannaBandhu. Dehra Dun. 364 pp.	
Suggested e-resources (Websites/e-books)	1. https://fsi.nic.in/forest-report-2021.	

Course Code: AEXT-111	**Course Name:** Rural Sociology and Educational Psychology	**Semester: I**

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
02	2	0	0				02		**B.Sc. (Hons), Agriculture**
Curriculum level							• Information based • Critical thinking based	**Student specific course outcome**	• Placement • Higher education

Objective: To make students fully aware with the Fundamentals of Agricultural Economics with intention to teach them about the basics of microeconomics, macroeconomics and also the banking system.

Course outcomes: Through this course students will be able to:

CO-1	Describe the importance and scope of rural sociology in dissemination of improved agricultural technologies to farming communities
CO-2	Understand the socioeconomic status of indian social groups in relation to assessing the feasibility of adaptation new agricultural technologies
CO-3	Apply the different psychological and behaviorist theories and methods in agriculture extension
CO-4	Analyze the role of various social Institution in socioeconomic develoment of agrarian society

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	Practical
AT1-3	End term
AT1-4	Quiz
AT1-5	Activity Based Learning
AT1-6	Assignment

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Sociology and Rural sociology: Definition and scope, its significance in agriculture extension	Quiz, Assignment, and Mid and End term and Practical records
	Unit –II Social Ecology, Rural society, Social Groups, Social Stratification	Quiz, Assignment, and Mid and End term and Practical records
	Unit -III Culture concept, Social Institution, Social Change & Development.	Quiz, Assignment, and Mid and End term and Practical records
	Unit -IV Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain	Quiz, Assignment, and Mid and End term and Practical records
	Unit-V Personality, Learning, Motivation, Theories of Motivation, Intelligence.	Quiz, Assignment, and Mid and End term and Practical records

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Sociometric Matrix. Sociogram and Index 2. Recourse Map 3. Social Map 4. Mobility Map 5. Johari Window 6. Differences Between Caste and Class 7. Social Stratification and Their factors	All Assignments and Practical's are evaluated on LMS and some in off line mode
Resources:	LCD, Black Board , Real Field Exposure	
Assignment/Tutor	Students are required to submit their assignment on LMS and in	

ial:	Practical records	
List of Assignments	1. Differences Between Caste and Class 2. Social Stratification and Their factors 3. Quiz	
Suggested reading:	1. A Text Book of Rural Sociology and Educational Psychology 1. Extension Communication and Management 2. A Text Book of Fundamental of Rural Sociology and Educational Psychology 3. Education and Communication for Developments	1 and 2 By Sagar Mondal 3. By K Ponnusawmi and Rajive Baliram Kale 4. O P Dhama and Bhatnagar
Suggested e-resources (Websites/e-books)	-	

Course Code: ENGL-111	Course Name: Comprehension and Communication Skills in English	Semester: I

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
02	1	0	1		02		B.Sc. (Hons) Ag
Curriculum level					• Information based • Critical thinking based • Research based	Student specific course outcome	• Higher education

Objective: To provide hands on training on various Comprehension and Communication Skills in English

Course outcomes: Through this course students will be able to:

CO-1	Describe role of communication skills in professional life
CO-2	Explain the Importance and process of various communication methods
CO-3	Demonstrate reading Comprehension
CO-4	Categorize the various vocabulary of English language
CO-5	Evaluate the various professional writings and their styles
CO-6	Develop writing and communication skills in English

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	Practical
AT1-3	End term
AT1-4	Quiz
AT1-5	Activity Based Learning
AT1-6	Assignment

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** War Minus Shooting – A lesson from the text book, "The Sporting Spirit" by George Orwell. A Dilemma – A lesson from the text book, "Layman looks at Science" by Raymond - B. Fosdick. You and Your English – A lesson from the text book," A Spoken English and Broken English" by G. B. Shaw.	Quiz, Assignment, and Mid and End term and Practical records
	Unit – 2 Reading Comprehension, Vocabulary- Synonyms, Antonyms, Homophones, Homonyms, often confused words.	Quiz, Assignment, and Mid and End term and Practical records
	Unit – 3 Functional Grammar – Tenses - Active voice and passive voice - Degrees of comparison and types of sentences - Direct and indirect speech and agreement of verb with subject functional grammar – Articles – Prepositions - Parts of speech and agreement verb with subject - Glossary.	Quiz, Assignment, and Mid and End term and Practical records
	Unit – 4 Written skills- Paragraph writing, precise writing, report writing and proposal writing. Importance of professional writing.	Quiz, Assignment, and Mid and End term and Practical records
	Unit-5 Preparation of Curriculum vitae and job applications, synopsis writing. Kinds, importance and process of interviews.	Quiz, Assignment, and Mid and End term and Practical records

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Effective listening – Developing listening skills – Honing listening skills. 2. Listening to short talks and lectures from the cassettes of EFL University. 3. Spoken english – Vowels – Consonants - Monophthongs, diphthongs, triphthongs. 4. Stress – Intonation - Phonetic transcription. 5. Seminars – Conferences - Preparation and demonstration. 6. Communication skills – Verbal communication - Written communication. 7. Telephonic conversation. 8. Meeting - Purpose, procedure, participation, physical arrangements.	All Assignments and Practical's are evaluated on LMS and some in off line mode
Resources:	LCD, Black Board , Real Field Exposure	

Assignment/Tutorial:	Students are required to submit their assignment on LMS and in Practical records
List of Assignments	1. Functional grammar 2. Writing skills Quiz
Suggested reading:	1. Balasubramanian, T. 1989. *A Text Book of Phonetics for Indian Student*, Orient Longman, New Delhi. 2. Balasubramanyam, M. 1985. *Business Communication.* Vani Education Books, New Delhi. 3. Jean Naterop, B. and Rod Revell. 1977. *Telephoning in English*. Cambridge University Press, Cambridge. Narayanaswamy V R. 1979. *Strengthen Your Writing.* Orient Longman, New Delhi.
Suggested e-resources (Websites/e-books)	

Course Code: AGRON -112	**Course Name:** Agricultural Heritage	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
1	1	0	0				1		**B.Sc. (Ag)**
Curriculum level							• Basic and applied	**Student specific course outcome**	Research Higher education

Objective: To implant a sense of pride amongst the agricultural students as our agriculture has sustainable practices for generations and to stimulate scientific research based on traditional technology.

Course outcomes: Through this course students will be able to:

CO-1	Describe the need and importance of Indian agricultural heritage and agricultural resources
CO-2	Understand the ancient agricultural practices and its relevant to modern agricultural practices
CO-3	Examine the various indigenous technical knowledge (ITK) used in agriculture
CO-4	Analyse the rich cultural and spiritual heritage of India in relation to agriculture

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-1** Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture;	Assignment
	Unit-II Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era;	Assignments Mid Term Examination
	Unit-III Plant production and protection through indigenous traditional knowledge, Crop voyage in India and world	Quiz
	Unit-IV Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications;	Activity Based Learning Flip Class/ Seminars Quiz
	Unit-V National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.	Flip Class/ Seminars Assignments End Term Examination

Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	Status of Agricultural Heritage used in different states of India
Suggested reading:	**H. Textbooks:** 1. S.R Reddy "Agriculture Heritage", 2018 A. Zaman and Sagar Maitra "Agriculture Heritage", 2018
Suggested e-resources (Websites/e-books)	1. https://icar.org.in/sites/default/files/Inventory%20of%20Indigenous%20Technical%20Knowledge%20in%20Agriculture%20Document%202.1.pdf https://naarm.org.in/itk/crop_itk1.php?crop=Pearlmillet

Course Code: CP- 111	**Course Name:** INTRODUCTORY BIOLOGY	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1		3		**B.Sc. (Ag)**
Curriculum level					Basic	**Student specific course outcome**	Higher Education Research

Objective: To give the student an overview of basic cell biology and its application to develop an understanding of basic biological concepts.

Course outcomes: Through this course students will be able to:

CO-1	Describe basic biological concepts of living organism
CO-2	Explain the origin and diversity of life on Earth and the evolutionary progression
CO-3	Demonstrate species richness in various plant families
CO-4	Analyse levels of organization and related functions in plants and animals.

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning

AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	**Unit – 1** Introduction to the living world. Diversity and characteristics of life, Origin of life, Evolution and Eugenics.	Socratic method, Presentation	Assignment, Quiz , Mid-term examinations
	Unit – 1I Binomial nomenclature and classification, Plant systematic-*viz*. Brassicaceae, Fabaceae and Poaceae.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Morphology and anatomy of flowering plants. Seed and seed germination.	Lecture method/ Presentation Field demonstration (ABL)	Skill test , Quiz. end term examinations
	Unit – IV Cell structure and function and cell cycle and cell division. Biomolecules	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Reproduction, Pollination and fertilization in plants, role of animals in agriculture.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Microscopy 2. Study of anatomy of roots, 3. Study of anatomy of stem, 4. Study of anatomy of leaf, 5. Study of modifications of roots, stem and leaves 6. Study of floral biology (Brassicaceae, Fabaceae and Poaceae) 7. Morphology of lowering plants - root, stem and leaf and their modifications. 8. Classification of Inflorescence, flower and fruits.	Spot Identification Practical Activity Practical Record Attendance Viva voce

Resources:	LCD, OHP, Black Board, Biology lab and tools, and field for demonstration
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	3. Preparation of family-wise plant identification database 4. Cell Cycle and Cell Division
Suggested reading:	**Textbooks:** 1. Biology – Raven P, Mason Johnson G B, Losos J. B, Singer. S.S , 10th edition, 2014. McGraw Hill Publications. 2. M.G. Simpson, 2006. Plant systematics. Elsevier Publications 3. H. C. Gangulee 1972 College Botany 4th edition. 4. A. C. Dutta 1964 A class book of Botany Botany for Degree Students, Oxford University Press, Calcutta. 5. N. T. Gill. 1966. Agricultural Botany. 2nd edition.
Suggested e-resources (Websites/e-books)	1. https://alec.unl.edu/documents/cde/2017/natural-resources/classification-and-naming-of-plants.pdf 2. https://open.lib.umn.edu/horticulture/chapter/2-1-plant-taxonomy 3. https://www.researchgate.net/publication/340660359_Botanical_classification_and_nomenclature_-_an_introduction

Course Code: STAT-111	**Course Name:** ELEMENTARY MATHEMATICS	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	2	0	0		2		**B.Sc. (Ag)**
Curriculum level					Basic	**Student specific course outcome**	Higher Education Placement

Objective: To encourage and enable students to understand the language ,symbol and notations of mathematics to develop logical skills

Course outcomes: Through this course students will be able to:

CO-1	Describe application of mathematical concepts such as matrix, integration, differentiation
CO-2	Understand the use of basic mathematical, trigonometry concepts and concept of calculus
CO-3	Apply appropriate methods to solve mathematical problems
CO-4	Analyse various mathematical model to solve a variety of practical problems

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test

AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines.	Assignment, Quiz , Mid-term examinations
	Unit – 1I Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2).	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of xn , ex , sin x & cos x from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it).	Skill test , Quiz. end term examinations
	Unit – IV Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it). Integral Calculus: Integration of simple functions, Integration of Product of two functions	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation	Seminar Presentation , Unannounced test, End term examination

Resources:	LCD, OHP, Black Board,
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
Suggested reading:	**A. Textbooks:** 1. Gorakh Prasad, 1985. Differential Calculus. Pothishal Private Ltd. Allahabad. 2. Gorakh Pasad, 1985. Integral Calculus, Pothishal rivate Ltd. Allahabad. 3. Loney SL 1905. Co-ordinate Geometry, Macmillian & Co. 4. Kala VN, 2009. Matrices. Laxmi publications. 5. MVSL DN Raju and K.V. Ramana - Agrcultural Mathematics.

Course Code: AEXT-112	**Course Name:** Human Values and Ethics	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
01	1	0	0				01		**B.Sc. (Hons) Agriculture**
Curriculum level							• Information based • Application based	**Student specific course outcome**	• Able to understand the human values and ethics

Objective: Creating awareness in students about Human values & ethics, social responsibility, spirituality and positive attitude

Course outcomes: Through this course students will be able to:

CO-1	Describe the basic concepts of human values and ethics
CO-2	Understand the significance of positive attitude, mental satisfaction and selfless service.
CO-3	Demonstrate the skills of philosophy of self-exploration
CO-4	Analyze the changes occurred in the thinking, nature and behaviour of humans with changing eras.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations Recorded videos
T2	Assignments Quiz Expert Lecture

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	National / International seminar
AT1-3	Quiz
AT1-4	Activity Based Learning
AT1-5	Workshop
AT1-6	Social activities
AT1-7	Expert Lecture

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Universal human aspirations: Happiness and prosperity & Management of anger and stress.	Class room teaching (chalk-board) Power Point Presentations Recorded videos
	Unit – 2 Human values and ethics: Concept, definition, significance and sources; Fundamental values: Right conduct, peace, truth, love and non-violence; Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction.	Class room teaching (chalk-board) Power Point Presentations Recorded videos Case study
	Unit – 3 Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.	Class room teaching (chalk-board) Power Point Presentations Recorded videos Case study
	Unit – 4 Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged and gender	Class room teaching (chalk-board) Power Point Presentations Assignments Quiz Case study Recorded videos
	Unit-V Spirituality, positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony; Modern challenges and value conflict: Sensitization against drug abuse and other social evils; developing personal code of conduct (SWOT Analysis);	Class room teaching (chalk-board) Power Point Presentations Assignments Participating in seminars. Recorded videos Expert Lecture

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. National /International seminar 2. Expert Lecture 3. Social Activities	Activity based learning can be given to implement

		application aspect
Resources:	LMS, Black Board, Seminar hall, Library	
Assignment/Tutorial:	Students are required to submit Minimum two assignments one Social activity report/Certificate.	
List of Assignments	1. Fundamental values of humans 2. Developmentally challenged and gender. SWOT Analysis	
Suggested reading:	1. Mathur SS. 2010. *Education for Values, Environment and Human Rights*. RSA International. 2. Sharma RP and Sharma M. 2011. *Value Education and Professional Ethics*. Kanishka Publishers. Srivastava S. 2011. *Human Values and Professional Ethics*. S K Kataria and Sons.	

Course Code: NSS-111	**Course Name:** National Service Scheme	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	0	0	2		4		**B.Sc. (Ag)**
culum level					Basic, applied	**Student specific course outcome**	Placement

Objective: To identify the needs and problems of the community and involve them in problem solving process.

Course outcomes: Through this course students will be able to:

CO-1	Describe the role and scope of NSS program activities
CO-2	Understand the community mobilization, Social harmony and national integration
CO-3	Organize various social activities
CO-4	Analyze the role citizenship, constitution and human rights

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

ssment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning

AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**essment tools**
	History, objectives, principles, symbol, badge, regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health, concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary, Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change, Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership, Indian history and culture, role of youth in nation building, conflict resolution and peace-building, Indian tradition of volunteership, its need, importance, motivation and constraints; shramdan as part of volunteerism, Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information, Concept of family, community (PRIs and other community based organisations) and society.	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, field, village, human society	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments		
Suggested reading:	**A. Textbooks:** 1. P. Ramachandra Rao and R.D. Sampath Kumar "Training of Trainers in National Service Scheme", 2017.	

Course Code: PED-111	**Course Name:** Physical Education and Yoga Practices	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	0	0	2		4		**.Sc. (Ag), HORT**
Curriculum level					Basic, applied	**Student specific course outcome**	Placement

Objective: To teach how to achieve good health, inner peace and harmony by using Yoga, meditation and spiritual development

Course outcomes: Through this course students will be able to:

CO-1	Describe the importance of physical education in professional life
CO-2	Understand the basics of various sports and yoga
CO-3	Demonstrate the skills variety of sports
CO-4	Analyze the impact of various sports and yoga on human well-being

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

ssment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment

AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	Teaching of skills of football- demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit), Teaching of different skills of Football- demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit), Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game, Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation, Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation, Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game, Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation, Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation, Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game, Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation, Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game, Teaching of some of Asanas – demonstration, practice, correction and practice, Teaching of some more of Asanas – demonstration, practice, correction and practice, Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation, Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation, Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game, Teaching – Meaning, Scope and importance of Physical Education, Teaching – Definition, Type of Tournaments, Teaching – Physical Fitness andHealth Education, Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball)..	Spot Identification Practical Activity Practical Record Attendance Viva voce

Resources:	LCD, OHP, Black Board, Yoga Ground, Running Track, Play Ground
Suggested reading:	**A. Textbooks:** H.L.Khatri "Health, Yoga and Physical Education", 2015.

Course Code: BNCC01GE03	**Course Name:** National Cadet Corps	**Semester:** I

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	0	0	2				4		**B.Sc. (Ag)**
Curriculum level							Basic, applied	**Student specific course outcome**	Placement

Objective: To develop character, comradeship, discipline, secular outlook, spirit of adventure and ideals of selfless service amongst young citizens

Course outcomes: Through this course students will be able to:

CO-1	Describe importance of NCC activities in professional life
CO-2	Identify various Command and control used in NCC
CO-3	Demonstrate various traditions and customs of India in relation to nation building
CO-4	Analyse various Values and ethical values, in reference to national integration
CO-5	Develop various leadership traits

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test

AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline, Drill- aim, general words of command, attention, stands at ease, stand easy and turning, Sizing, numbering, forming in three ranks, open and close order march and dressing, Saluting at the halt, getting on parade, dismissing and falling out, Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear, Turning on the march and wheeling. Saluting on the march, Marking time, forward march and halt, Changing step, formation of squad and squad drill, Command and control, organization, badges of rank, honors and awards, Nation Building- cultural heritage, religions, traditions and customs of India. National Integration, Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen, Leadership traits, types of leadership. Character/personality development, Civil defense organization, types of emergencies, fire fighting, protection, Maintenance of essential services, disaster management, aid during development projects, 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, Structure and function of human body, diet and exercise, hygiene and sanitation, Preventable diseases including AIDS, safe blood donation, first aid, physical and mental Health, Adventure activities, Basic principles of ecology, environmental conservation, pollution and its control, Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self-defense.	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, field, village, human society	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
Suggested reading:	**A. Textbooks:** 1. R.K.Gupta "Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations", 2020	

II SEMESTER

Course Code: GPB-121	**Course Name: :** Fundamentals of Genetics	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Ag), GPB**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research

Objective: This course is aimed at understanding the basic concepts of genetics, helping students to develop their analytical, quantitative and problem solving skills from classical to molecular genetics.

Course outcomes: Through this course students will be able to:

CO-1	Describe the basic concept of genetics
CO-2	Understand the various principles and laws of heredity
CO-3	Demonstrate the deviations from mendelian inheritance with scientific explanations
CO-4	Analyse the nature, structure and functions of cell and genetic materials
CO-5	Determine the inheritance pattern of a given trait

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination

AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit –I** Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis.	Presentation
	Unit -II Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation.	Midterm examination Report writing
	Unit-III Crossing over mechanisms, recombination and Genetic mapping, genetic transposition: transposon or jumping gene, Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation.	Assignment Field trial
	Unit-IV Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance.	ABL Quiz
	Unit-V Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons. Basic concepts of eugenics and epigenetics	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Study of microscope. 2. Study of cell structure. 3. Mitosis and Meiosis cell division. 4. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, 5. Experiments on epistatic interactions including test cross and back cross, 6. Practice on mitotic and meiotic cell division, 7. Experiments on probability and Chi-square test. 8. Study of models on DNA and RNA structures.	Spot Identification Practical Activity Practical Record Attendance

		Viva voce
Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.	
Assignment/ Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Cell structure and cell division 2. Structural and numerical changes in chromosomes	
Suggested reading:	**A. Textbooks:** 1. Gardner EJ &Snustad DP. 1991. *Principles of Genetics*. John Wiley &Sons. 2. Klug WS & Cummings MR. 2003. *Concepts of Genetics*. Peterson Edu. 3. Lewin B. 2008. *Genes IX*. Jones & Bartlett Publ. 4. Russell PJ. 1998. *Genetics*. The Benzamin/Cummings Publ. Co. 5. Snustad DP & Simmons MJ. 2006. *Genetics*. 4th Ed. John Wiley & Sons. 6. Strickberger MW. 2005. *Genetics (III Ed)*. Prentice Hall, New Delhi, India 7. Tamarin RH. 1999. *Principles of Genetics*. Wm. C. Brown Publs. 8. Uppal S, Yadav R, Subhadra & Saharan RP. 2005. *Practical Manual onBasic and Applied Genetics*. Dept. of Genetics, CCS HAU Hisar.	
Suggested e-resources (Websites/e-books)	1. https://core.ac.uk/download/pdf/219474613.pdf 2. https://www.nature.com/scitable/topicpage/thomas-hunt-morgan-genetic-recombination-and-gene-496/	

Course Code: MICROB-121	**Course Name:** Agricultural Microbiology	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag)**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Research

Objective: To understand the basic microbial structure, function, bio-geochemical cycles, growth requirements of bacteria and production of beneficial bacteria.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe various microbe types with emphasis on plant parasitic and beneficial organisms and their significant role in agriculture
CO-2	Discuss the growth and reproduction pattern of different agricultural microbes
CO-3	Demonstrate the fundamental techniques which are necessary in culturing of the microbes.
CO-4	Analyse the role of microbes in affecting the productivity of agricultural crops and quality of agriculture produce
CO-5	Evaluate the isolated fungi and bacteria with reference to their potential utilization in enhancing the biotic and abiotic stress in crop plants

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Introduction- Scope of microbiology; brief history of microbiology, Microbial world Prokaryotic and eukaryotic microbes and their differences, Bacteria- Detailed cell structure of bacteria, Phases in bacterial growth, synchronous and diauxic growth.	Class room teaching (chalk-board) Power Point Presentations
	Unit – 2 Microbial Nutrition- Autotrophy-chemoautotrophy, photo autotrophy, heterotrophy. Bacterial genetics- Genetic recombination- transformation, conjugation and transduction plasmids, transposon	Assignments And Quiz
	Unit – 3 Role of microbes in soil fertility and crop production: Carbon cycle. Nitrogen, Phosphorus and Sulphur cycles.	Class room teaching (chalk-board) Power Point Presentations
	Unit – 4 Biological nitrogen fixation symbiotic, associative and asymbiotic, Azolla, blue green algae, Actinorrhizal symbiosis- Frankia. Phosphorus solubilizing microrganisms and mycorrhiza. Rhizosphere and phyllosphere, PGPR microorganisms.	Assignments And Quiz
	Unit-5 Microbes in human welfare, Types of Fermentation and Fermentation technology, Biofertilizers and silage production technology, Biopesticides-Mode of action, types of biopesticides, Biofuel production and biodegradation-of agrowaste- Gobar gas and composting technology.	Class room teaching (chalk-board) Power Point Presentations

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Study the basics of microbiology laboratory and its equipments. 2. Study the microscope- Parts, principles of microscopy, resolving power and numerical aperture. Study understand the different techniques of sterilization 3. Study the preparation of different type of solutions and media 4. Calculate the concentration of different solutions (ppm, percentage, Molarity and Normality) 5. Preparation of buffers and Estimation of pH 6. Bacterial Staining procedures: Simple staining, Gram's staining and Endospore staining 7. Enumeration of microbial population in soil samples- bacteria, fungi and actinomycetes 8. Methods of isolation, purification and maintenance of microbial cultures 9. Isolation of Rhizobium from legume root nodule	Activity based learning can be given to implement application aspect

	10. Isolation of BGA	
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Biological nitrogen fixation cycle and mechanisms 2. Impact analysis of PGPR microorganisms of crop productivity 3. Novel and innovative technology for biodegradation-of agro-waste	
Suggested reading:	**A. Textbooks:** 1. Microbiology. Pelczar, J.r., M.J.E.C.S.Chan and Krieg, N.R. (5th Ed.) 2015. McGraw Hill Publishers, New York. 2. Microbiology. Prescott, L.M., Harley, J.P. and Klein, D.A. (9th Ed.) 2014. McGraw Hill Publishers, New York. 3. Brock Biology of Microorganisms.Madigan, M.,Martinko, J.M and Parker, J. (14Ed.) 2015. Prentice hall of India Pvt Ltd., New Delhi. 4. Soil Microbiology: SubbaRao, N.S. (4th Ed.) 2014. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi. 5. Microbiology A Laboratory Manual: James, C and Natile, S. (10th Ed.) 2014. Pearson India Education Services Pvt. Ltd., South Asia. 6. Experiments in Microbiology, Plant Pathology and Biotechnology.Aneja, K.R.2011. New Age International (P) Ltd., Publishers, New Delhi.	
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/19624/1/Book%20chepter%207%20july%202018.pdf 2. https://sawbar.in/wp-content/uploads/2018/07/67130-168498-1-SM.pdf 3. https://www.frontiersin.org/articles/10.3389/fmicb.2021.688695/full	

Course Code: AENG-121	Course Name: : Soil and Water Conservation Engineering	Semester: II

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		B.Sc. (Ag)
Curriculum level							Information based Critical thinking based Research based	Student specific course outcome	Placement Research Higher education

Objective: To reduce all forms of soil erosion from Agricultural Land and increase agricultural productivity in sustained manner by Soil and water Conservation works.

Course outcomes: Through this course students will be able to:

CO-1	Describe the importance of soil and water conservation in natural resource management
CO-2	Understand the mechanism of various processes of soil erosion
CO-3	Apply appropriate soil & water conservation techniques in a various field conditions
CO-4	Examine the effect of erosion problem in the soil
CO-5	Evaluate the soil loss by different empirical equations and RS & GIS technique
CO-6	Design various soil & water conservation structures in order to control soil erosion and subsequent safe disposal of water

Teaching Pedagogy:

T1	Class room teaching, Lab Experiments (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation and Report
AT1-3	Quiz
AT1-4	Poster

AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field Visit Report
AT1-9	Assignment

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit-I:** Surveying: Survey equipment's, chain survey, cross staff survey, calculation of area of regular and irregular fields, leveling- leveling equipment's.	Assignment Field visit
	Unit-II: Introduction to Soil and Water Conservation causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures.	Mid Term examination Poster
	Unit-III: Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing.	Class room teaching (Chalk-board) Presentation
	Unit-IV: Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.	Class room teaching (Chalk-board) ABL Quiz
	Unit-V: Introduction to irrigation. Irrigation water measurement methods and instruments-,Weirs – Orifice – Flumes. Rainfall erosivity - estimation as EI30 index and kinetic energy, methods of measurement and prediction of runoff, land capability classification.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. General status of soil conservation in India 2. Calculation of erosion index. 3. Estimation of soil loss. 4. Preparation of contour maps. 5. Design of grass waterways 6. Design of contour bunds 7. Design of graded bunds. 8. Design of bench terracing system 9. Design of farm pond	Practical Activity Practical Record Viva voce Spot Identification Field Visit

	10. Visits to watershed	
Resources:	LCD, OHP, Black Board, Soil water conservation Lab.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Status of soil erosion problem in different states of India Prepare a planning of watershed	
Suggested reading:	1. Ghanshyam Das., 2012. *Hydrology and Soil Conservation Engineering, including Watershed Management.*Second edition, PHI Learning Private Limited,New Delhi - 110001 2. Murthy, V. V.N., 2004. *Land and Water Management Engineering.*Kalayani Publishers, New Delhi 3. Michael A.M., 2007. *Irrigation Theory and Practice*.Second edition.Vikas Publishing House Pvt. Ltd. 4. Mal, B. C. 1995. *Introduction to Soil and Water Conservation Engineering*.Kalayani Publishers, Rajinder Nagar, Ludhiana 5. Kanetakar, T. P. 1993. *Surveying and Leveling*. Pune VidyarthiGriha, Prakashan, Pune 6. Suresh, R. 2008. *Land and Water Management.*Standard Publishers Distributors, Delhi.	
Suggested e-resources (Websites/e-books)	1. http://ecoursesonline.iasri.res.in/course/view.php?id=54 2. https://archive.nptel.ac.in/courses/126/105/126105012/	

Course Code: CP-121	**Course Name:** Fundamentals of Crop Physiology	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Hons.)Agriculture**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective: To impart knowledge to the students about different physiological aspects, metabolic processes and role of plant growth regulators that determines growth and development of crops.

Course outcomes: Through this course students will be able to:

CO-1	Describe the role and importance of plant physiology in crop growth and development
CO-2	Explain the functions of various mineral nutrients in crop physiology
CO-3	Demonstrate the effect of plant growth regulators or phyto-hormones in development of crop plants
CO-4	Analyse the different metabolic pathways of bio-molecules
CO-5	Determine the different physiological growth parameters involved in development of agricultural crops

Teaching Pedagogy:

T1	Activity based learning through lab experiments Power Point Presentations and white board teaching
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid Term Exam and End Term Exam
AT1-2	Seminar Presentation
AT1-3	Class Test/Quiz
AT1-4	Poster Presentation

AT1-5	Activity Based Learning
AT1-6	Viva voce Examination
AT1-7	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Introduction and historical perspectives and importance of crop physiology in agriculture. Plant cell and cytoplasmic organelles: structure and functions.	Presentation Quiz
	Unit – 2 Absorption of water: diffusion & osmosis. Mechanism of absorption of water and ascent of sap. Transpiration: kinds of transpiration and factors affecting transpiration. Stomata: diffusion through stomatal pore, mechanism of opening and closing of stomata and guttation.	ABL Mid Term Examination
	Unit – 3 Introduction: essential elements and criteria of essentiality of minerals, physiological roles of mineral nutrients. Nutrient uptake mechanism and factors affecting salt absorption.	Assignment
	Unit – 4 Photosynthesis: Light and dark reactions, C3, C4 and CAM plants, photorespiratio Respiration: Glycolysis, Kreb's cycle and electron transport chain; Fat Metabolisı Fatty acid synthesis and breakdown.	ABL Assignment Quiz
	Unit-V Plant growth regulators: Physiological roles and agricultural uses, physiologic aspects of growth and development of major crops. Growth analysis: role physiological growth parameters in crop productivity.	ABL Spotting Viva Voce End Term Examination

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Introduction to laboratory. 2. Laboratory glassware uses and cleaning. 3. Study of plant cell and its cellular organelles. 4. Structure and distribution of stomata. 5. Determination of the percentage of water imbibed by gram seeds. 6. Demonstration of the process of osmosis with varying solutio concentration.	Practical Activity Practical Record Viva voce Spot Identification

	7. Demonstrate of plasmolysis using onion cells. 8. Comparison of rate of transpiration between the upper and lower surfaces o a leaf.	
Resources:	LCD, OHP, Black Board, Genetics & Plant Breeding Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Essential elements and criteria of essentiality of minerals. Physiological roles of mineral nutrients. 2. Nutrient uptake mechanism and factors affecting salt absorption. Metabolic Pathways of Respiration: Glycolysis, Kreb's cycle and electron transport chain;	
Suggested reading:	**A. Textbooks:** 1. Bidwell, R.G.S 1995. Plant Physiology, Macmillan Publishers Co., NewYork . 2. Delvin, R.M. and Witham, F.H. 1986. Plant Physiology CBS Publishers &Distributors, Delhi. 3. Frank, B. Salisbury and Cleon, W. Ross, 2005. Plant Physiology, CBS Publishers & distributors, Delhi. 4. Gardener, P., Brent Pearce, R. and Roger, L. Mitchell, 1985. Physiology of Crop Plants. Jodhpur Scientific Publications, Jodhpur. 5. Hopkins, W.G. and Huner, N.P.A. 2004. Introduction to Plant Physiology. JohnWiley & Sons. 6. Jain, J.K. 2007. Fundamentals of plant physiology, S. Chand & Company Ltd., New Delhi. 7. Pandey, S.N. and Sinha, B. K 2006. Plant physiology, Vikas Publishing House Private Limited, New Delhi. **B. Reference books:** 1. Lincoln Taiz and Eduardo Zeiger 2006. Plant Physiology, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts. 2. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi. 3. Ray, G. Noggel and George, J. Fritz 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi. 4. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.	

Course Code: AE-121	Course Name: Fundamentals of Agricultural Economics	Semester: II

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	2	0	0				2		**B.Sc. (Hons), Agriculture**
Curriculum level							• Information based • Critical thinking based	**Student specific course outcome**	• Placement • Higher education

Objective: To make students fully aware with the Fundamentals of Agricultural Economics with intention to teach them about the basics of microeconomics, macroeconomics and also the banking system.

Course outcomes: Through this course students will be able to:

CO-1	Describe the micro and macro level of Indian agriculture
CO-2	Illustrate of the law of demand and supply
CO-3	Demonstration of Market Structure, Market Force, and National Income in Our Indian Agricultural Sector
CO-4	Examine the bank's credit policy and the manner in which Indian banks operate.

Teaching Pedagogy:

T1	Activity based learning through Power Point Presentations
T2	ABL activities Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Viva voce examination
AT1-5	

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.	Classroom teaching ABL
	Unit – 2 Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply.	Classroom teaching ABL Mid-term Exam
	Unit – 3 Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.	Classroom teaching ABL
	Unit – 4 National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation.	Classroom teaching ABL

	Unit-5 Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.	End term examination ABL Viva Voce

Resources:	LCD, White Board
Assignment/ Tutorial:	
List of Assignments	
Suggested reading:	**Textbooks:** 1. Elementary Economic Theory: K. K. Dewett and J. D. Varma 2. Modern Economic Theory: K. K. Dewett. 3. Advanced Economic Theory: H. L. Ahuja. **Reference Book:** S.Subba reddy, P.Raghu Ram, T.V.Neelakanta sastry and Bhavani Devi. 2019.Agricultural economics.Oxford; 2nd edition.
Suggested e-resources (Websites/e-books)	

Course Code: PP-121	**Course Name:** Fundamentals Plant Pathology	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
4	3	0	1				5		**B.Sc. (Ag),**
Curriculum level							• Informationbased • Critical thinkingbased • Research based	**Student specific course outcome**	• Placement • Research • Higher education • Higher education

Objective: To provide first hand information related to various plant pathogens.

Course outcomes: Through this course students will be able to:

CO-1	Highlighting the scope and objective of plant diseases and its development.
CO-2	Interpret about various pathogens including bacteria, fungus, virus and nematodes and their life cycles
CO-3	Experimenting concept of disease, causal agents of plant diseases
CO-4	Explaining important microorganisms and understand host pathogen interactions
CO-5	Experimenting to analyze and identify the causal organisms of diseases.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing

AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Introduction: Importance of plant diseases, scope and objectives of Plant Pathology.History of Plant Pathology with special reference to Indian work.Terms and concepts in Plant Pathology. Disease triangle and tetrahedron and classification of plant diseases. Diseases and symptoms due to abiotic causes.	Presentation
	Unit – 3 Fungi: General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.	Mid Term examination Report writing
	Unit – 3 Causes and factors affecting disease development. Important plant pathogenic organisms (different groups): fungi, bacteria, phytoplasma, spiroplasma, viruses, viroids, algae, protozoa and phanerogamic plant parasites with example of diseases caused by them.	Assignment Field trial
	Unit – 4 Bacteria and mollicutes: General morphological characters. Basic methods of classification and reproduction. Viruses: Nature, architecture, multiplication and transmission and phanerogamic plant parasites with example of diseases caused by them.	ABL Quiz
	Unit-V Growth and reproduction of plant pathogens. Liberation, dispersal and survival of plant pathogens.Types of parasitism and variability in plant pathogens.Pathogenesis role of enzymes, toxins and growth regulators in disease development.Defence mechanism in plants. Epidemiology: Factors affecting disease development.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**

	2. Acquaintance with various laboratory equipments and microscopy. 3. Sterilization techniques 4. Preparation of PDA. 5. Isolation of fungal pathogen 6. Preparation of media, isolation and Koch's 7. General study of different structures of fungi. 8. Study of representative fungal genera. 9. Staining and identification of plant pathogenic bacteria.	Practical Activity Practical Record Viva voce Spot Identification
Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	3. Study of representative fungal genera. General study of different structures of fungi	
Suggested reading:	**Textbooks:** 1.Introduction To Principles Of Plant Pathology by R S Singh 2.Modern Plant Pathology (SECOND EDITION) (HB) by DUBE H.C. 3.A Textbook of Fungi, Bacteria and Viruses (Student Edition)by H.C. Dube 4.Fundamentals of Plant Pathology by Aggarwal Mehrotra	

Course Code: ENT-121	**Course Name:** Fundamentals of Entomology	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
04	4	3	1				05		ENT-211
Curriculum level							• Information based • Practical based • Research based	**Student specific course outcome**	• Placement • Research • Higher education • Higher education

Objective:

- For understanding of basic concepts of insect morphology and life cycle.
- To determine structure of insect body segment and associated appendages.
- To elaborate the insect physiological metabolic systems and relation to their ecosystem and their integrated management tactics.

Course outcomes: Through this course students will be able to:

CO-1	Describe the structure and function of insect along with their ecology.
CO-2	Classify insects according to their morphology, anatomy and physiology.
CO-3	Demonstrate the relationship of insect appendages with their habit and habitat.
CO-4	Analyse the effect of climatic conditions on insect life.
CO-5	Evaluate the insect behavior in relation to other organisms present in their niche and ecosystem.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars One word/ single phrase answer tests

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Insect Collection and Preservation
AT1-3	One word/ single phrase answer tests
AT1-4	Group discussion

AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Laboratory experiments performance
AT1-8	Field Application
AT1-9	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus.	Group discussion
	Unit – 2 Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.	Mid Term examination ABL
	Unit – 3 Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.	One word/phrase questions Poster
	Unit – 4 Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, antifeed ants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.	ABL One word/phrase questions
	Unit – 5 Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species,	End term examination Viva Voce

	Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.	

Practical Exercise*	Course Modules	**Assessment tools**
	1. Methods of collection and preservation of insects including immature stages; 2. External features of Grasshopper/Blister beetle; 3. Types of insect antennae, mouthparts and legs; 4. Wing venation, types of wings and wing coupling apparatus. 5. Types of insect larvae and pupae; 6. Dissection of digestive system in insects (Grasshopper); 7. Dissection of male and female reproductive systems in insects (Grasshopper); 8. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. 9. Insecticides and their formulations. 10. Pesticide appliances and their maintenance. 11. Sampling techniques for estimation of insect population and	1. Insect Collection and Preservation 2. Laboratory based experiments performance 3. Identification of insect orders based on characteristics 4. Sampling Methods in field 5. Maintenance of practical record

	damage.	
Resources:	White Board, Models present in the lab, Demonstration in the laboratory and field, Entomology Laboratory	
Assignment/ Tutorial:	Students are required to take part in given assignments and attend one word/ single phrase tests a part of their continuous evaluation system.	
List of Assignments	**A. Collection and Preservation of Insect Pests of orders:** 5. Orthoptera 6. Isoptera 7. Hemiptera 8. Neuroptera 9. Coleoptera 10. Lepidoptera 11. Hymenoptera 12. Diptera etc. A. Model Preparation (Types of antennae, legs, wings) **B. Topic for GD (Group Discussion):** Insect Dominance in nature	
Suggested reading:	**Text Books:** 1. Insecta an Introduction and Principle of Applied Entomology, K.N. Ragumoorthi, V. Balasubramani, M.R. Srinivasan, N. Natarajan. A.E. Publications, ISBN : 9788190255820 2. An Outline of Entomology – G. S. Dhaliwal, Kalyani Publishers 3. **P.D. Srivastava et al.,** 1983. Agricultural entomology. Volume 1 and Volume 2. (All India scientific writer's society). 4. **O.S. Bindra & Harcharan Singh,** 1971. Pesticide application equipment. (Oxford & IBH). 5. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. *General and Applied Entomology.* Tata McGraw-Hill Publishing House, New Delhi. **Reference Books:** 6. Introduction to Insect Pest Management - Metcalf, R. L .and Luckman, W. H (Wiley inter science publishing, New York) 7. Entomology and Pest Management – Larry P Pedigo **I.V.N. Fadeev & K.V. Novozhilov,** 1987. Integrated plant protection. (Oxonian Press, N. Delhi)	
Suggested e-resources (Websites/e-books)	THE WASHINGTON STATE UNIVERSITY INSECT COLLECTION (https://museum.entomology.wsu.edu/) University of California Agriculture and Natural Resources, Statewise Integrated Pest Management Program (https://ipm.ucanr.edu/)	

Course Code: AEXT- 121	**Course Name:** Fundamentals of Agricultural Extension Education	**Semester:** II

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Ag)**
Curriculum level					Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective:

Course outcomes: After completion of course, the student will be able to:

CO-1	Remember the concept and need of Extension education.
CO-2	Understand the various tools and elements of extension education.
CO-3	Apply rural and community development Program in village and local area.
CO-4	Analyse the extension system in India and various policies of government.
CO-5	Evaluate new trends and schemes under extension education

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test

AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; Objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.	Mid term
	Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.).	Assignment Mid term
	New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India.	Assignment ABL Activities
	Community Development -meaning, definition, concept & principles, Physiology of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.	End term Exam Assignment Viva voce
	Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies; journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.	Assignment Viva voce

Practical Exercise*	List of practicals (field/lab exercises)	Assessment tools
	1. To get acquainted with university extension system 2. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector 3. Preparation and use of AV aids 4. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories	

	5. Presentation skills exercise; micro teaching exercise; 6. A visit to village to understand the problems being encountered by the villagers/ farmers; 7. Study organization and functioning of DRDA and other development departments at district level; 8. Visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: 9. Visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.	
Resources:	LCD, OHP, Black Board, Extension Lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Extension systems in India 2. Extension/ agriculture development programmes launched by ICAR/ Govt. of India 3. New trends in agriculture extension	
Suggested reading:	**A. Text and Reference books:** 1. De, D. and Jirli, B. (2010). A Handbook of Extension Education. Agrobios (India), Jodhpur. 2. Mondal, S. (2019). Fundamentals of Agricultural Extension Education. Kalyani publishers, New Delhi. 3. Adivi Reddy, A. 2006. Extension Eduation. Sree Lakshmi Press, Bapatla. 4. Dahama, O.P. and Bhatnagar, O.P. 1999. Extension and Communication for Development. Oxford & IBH Private Limited, New Delhi/Mumbai. 5. Ganesh, R., Mohammad Iqbal and Ananda Raja. 2003. Reaching the Unreached Basics of Extension Education. Associate Publishing Company, New Delhi. 6. Jalihal, K.A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education an Management in Extension. Concept Publishing House, New Delhi. 7. Ray, G.L. 2006. Extension Communication and Management. NayaProkash/Kalyan Publishers, Kalkatta/Ludhiana.	
Suggested e-resources (Websites/e-books)	1. https://icarzcu3.gov.in/book_publications/Concepts_2nd_Edn/2Chapter%201.pdf 2. https://agricoop.nic.in/sites/default/files/FFH201819_Eng.pdf	

Course Code: AEXT 122	**Course Name:** Communication skills and Personality development	**Semester:** II

Credits	**L**	**T**	**P**	**Max. Marks**			**Contact Hours (per week)**	**Independent Study Hours (per week)**	**Section (Group)**
02	1	0	1				03		**B.Sc. (Hons.) Agriculture**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective: To acquaint with the communication skills and personality development

Course outcomes: After successful completion of the course, the students are expected to

CO-1	Remember various communication skills.
CO-2	Understand the reading writing techniques of general and technical articles.
CO-3	Apply the knowledge of domains and components in understanding the human behaviour.
CO-4	Analyse the psychology of social interactions for ego and behaviour of communicator.
CO-5	Evaluate the role of writing skills in the overall personality development

Teaching Pedagogy

T1	Activity based learning through lab experimentation Power Point Presentation
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	One Midterm and End term Examination
AT1-2	Seminar Presentation and Report
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Review writing
AT1-7	Viva voce examination

	Module wise details	Assessment tools
Course Contents	**UNIT-I:** Communication skills; meaning and process of communication, verbal and non-verbal communication.	Mid term
	UNIT-II: Listening and note taking, writing skills, oral presentation skills; field diary and lab record.	Assignment Mid term
	UNIT-III: Structural and functional grammar, indexing, footnote and bibliographic procedures.	Assignment ABL Activities
	UNIT-IV: Reading and comprehension of general and technical articles, individual and group presentations, impromptu presentations, public speaking; group discussion,	End term Exam Assignment Viva voce
	UNIT-V: Precise writing, summarizing, abstracting; organising seminars and conferences.	Assignment Viva voce

Assignment	1. Writing of technical articles 2. Oral presentation on various themes
Reference	• Barker, A. (1956). Improve Your Communication Skill. 2nd ed. Kogan PagePublishers. UK. • Berlo, D. K. (1960). The Process of Communication: An introduction to Theoryand Practice. New York, NY: Holt, Rinehart, and Winston. • Castells, M. (2009). Communication Power. Oxford University Press, NewDelhi. • CBE Style Manual: A Guide for Authors, Editors and Publishers. (1983) . 5th ed.Council of Biological Editors, Bethesda, Maryland, USA. • Cragan, F.J. and Wright, W.D. (1999). Communication in Small Groups –Theory, Process,Skills. Wadsworth Publ., London. • Day, R. A. (1998). How to Publish a Scientific Paper. 5th ed. Oryx Press,Westport, Connecticut. • Gordon, H. M. and Walter, J. A. (1970). Technical Writing. 3rd ed. Holt, Rinehartand Winston. • Greene, J. O. and Burleson, B. R. (2003). Handbook on Communication andSocial Interaction Skills. Lawrence Erlbaum Associates, Inc., New Jersey. • Hargie, O. (2006). The Handbook on Communication Skills. RoutledgePublication, New York. • Hauser, M. D. (1997). The Evolution of Communication. MA, MIT Press,Cambridge, USA. • Leggett, G., Mead, C. D., Charvat, W. and Beal, R. S. (1982). Handbook forWriters. 8th ed. Prentice- Hall, USA. • Joseph, G. (2000). MLA Handbook for Writers of Research Papers. 5th ed.Affiliated East-West

	Press. New Delhi. • Mcquail, D. and Windahl, S. (1993). Communication Models for theStudy ofMass Communications. Longman Publ., London. • Ray, G.L. (1991). Extension, Communication and Management. Naya Prokash,Calcatta. • Rogers, E.M. and Shoemaker, F.F. (1971). Communication of Innovations: ACross – Cultural Approach. The Free Press, New York. • Rogers, E. M. (2003). Diffusion of Innovations. The Free Press. New York. • Roloft, M. F. (1981). Interpersonal Communication. Sage Publ., USA

III SEMESTER

Course Code: AGRON-211	**Course Name:** Crop production technology-I (Kharif)	**Semester:** III

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Ag), AGRON**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To learn about the complete cultivation practices, problems and management for the production of kharif crops

Course outcomes: Through this course students will be able to:

CO-1	Describe the nutraceuticals values and economic importance of various Kharif agricultural crops
CO-2	Understand the soil and climatic requirements of different Kharif crops
CO-3	Demonstrate the nursery preparation and transplanting in rice
CO-4	Examine the impact of various biotic and abiotic stress on the productivity of different crops
CO-5	Determine the cost of cultivation of different crops

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools

AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit – 1** Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif Cereals crops, *viz*., rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier	Assignment, Quiz , Mid-term examinations
	Unit – 1I Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif pulses crops, *viz*., pigeonpea, mungbean and urdbean	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif oilseeds crops, *viz*., groundnut, and soybean	Skill test , Quiz. end term examinations
	Unit – IV Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif fibre crops, *viz*., cotton & jute	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif forage crops, *viz.,* sorghum, cowpea, cluster bean and napier grass	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	11. Sowing and transplanting methods of rice 12. Sowing methods of different Kharif crops	Spot Identification Practical Activity

	13. Identification of weeds in kharif season crops 14. Study of morphological characteristics of kharif crops 15. Study of yield contributing characters of kharif season crops 16. Yield and protein percent analysis of green gram and black gram 17. Study of important agronomic experiments of kharif crops at experimental farms. 18. Visit to research stations of related crops	Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, Horticulture lab and tools, Gardens, and field for demonstration, Polyhouse, Net house, Processing unit/post-harvest lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Full Case study of Kharif crop.	
Suggested reading:	**A. Textbooks:** 1. Bahl, P.N., P.N. Salimath and A.K. Mandal, 1998, Genetics, Cytogenetics and Breeding of crop Plants, Oxford and IBH Publishers & Co., New Delhi. 2. Chopra, V.L. 1994 Plant breeding – Theory and Practices. Oxford and IBH Publishers, New Delhi. 3. Hari, H. R. and Singh, H.G. 2006. Crop breeding and genetics, Kalyani Publishers, New Delhi. 4. Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR. 5. Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH. 6. Singh, SS. 1998. Crop Management. Kalyani. 7. Yadav DS. 1992. Pulse Crops. Kalyani. 8. Panda (2006): Agronomy.	
Suggested e-resources (Websites/e-books)	1. http://www.iiwm.res.in/pdf/Bulletin_69.pdf 2. https://icar-nrri.in/wp-content/uploads/2019/08/11.-NRRI-Research-Bulletin-9.pdf	

Course Code: GPB-211	Course Name: Fundamentals of Plant Breeding	Semester: III

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	2	0	1		4		B.Sc. (Ag), GPB
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To improve the genetic makeup of the crop plants by improving yield, quality, disease-resistance, drought and frost-tolerance and important characteristics.

Course outcomes: Through this course students will be able to:

CO-1	To impart knowledge on the principles and procedures of plant breeding.
CO-2	Explain various breeding methods, their significance and drawbacks.
CO-3	Demonstrate the high yielding varieties/hybrids through various conventional and modern molecular approaches
CO-4	Inference of genetic basis and methods of breeding.
CO-5	Determine to assess food security through breeding tools and Intellectual Property coverage

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment

AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**UNIT-I:** Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding; Modes of reproduction and apomixes, Modes of pollination	Assignment ABL activities
	UNIT II: Self-incompatibility and male-sterility, its genetic consequences; Domestication, acclimatization and introduction; Centers of origin/ diversity; Plant genetic resources, Components of genetic variation, heritability and genetic advance.	Mid term ABL activities
	UNIT III: Genetic basis and breeding methods in self-pollinated crops, mass and pure line selection, hybridization technique and handling of segregating population, multiline concept; Concepts of population genetics and Hardy- Weinberg law.	ABL activities
	UNIT IV: Genetic basis and methods of breeding in cross-pollinated crops; modes of selection; Population improvement schemes: Ear-to-row method, Modified ear-to-row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties.	Herberia Spotting
	UNIT V: Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre breeding; Polyploidy in relation to plant breeding; Mutation breeding- methods and uses; Breeding for important biotic and abiotic stresses; Ideotype Breeding, Biotechnological tools-DNA markers and marker assisted selection. Speed Breeding, participatory plant breeding; UPOV and PPV&FR act, 2001.	Assignment End term Examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Plant Breeder's kit; Study of germplasm of various crops. 2. Hybridization: emasculation and Pollination. 3. Study of male sterility system	Activity based learning can be given to implement

	4. Test of pollen viability. 5. Handing of segregation populations. 6. Estimation of heterosis, inbreeding depression and heritability. 7. Methods of calculating mean, range, variance, standard deviation. Designs used inplant breeding experiment, analysis of Randomized Block Design	application aspect
Resources:	LCD, Black/White Board, Laboratory, Agricultural farm	
Assignment/ Tutorial:	Students are required to submit prepare lab manual, assignments and ABL activities as a part of their continuous evaluation system.	
List of Assignments	13. Polyploidy Breeding 14. Mutation Breeding 15. Marker Assisted Selection	
Suggested reading:	**A. Textbooks:** 1. Abraham Z. 2017. Fruit Breeding. Agri-Horti Press, New Delhi. 2. Badenes ML and Byrne DH. 2012. Fruit Breeding. Springer Science, New York. 3. Dinesh MR. 2015. Fruit Breeding, New India Publishing Agency, New Delhi. 4. Ghosh SN, Verma MK and Thakur A. 2018. Temperate Fruit Crop Breeding- Domestication to Cultivar Development. NIPA, New Delhi. 5. Hancock JF. 2008. Temperate Fruit Crop Breeding: Germplasm to Genomics. Springer Science, New York. 6. Jain SN and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Tropical Species. Springer Science, New York. 7. Jain SN and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Temperate Species. Springer Science, New York. 8. Janick J and Moore JN. 1996. Fruit Breeding. Vols. I–III. John Wiley & Sons, USA. 9. Kumar N. 2014. Breeding of Horticultural Crops:Principles and Practices. NIPA, N. Delhi. 10. Moore JN and Janick J. 1983. Methods in Fruit Breeding. Purdue University Press, USA. 11. Ray PK. 2002. Breeding Tropical and Subtropical Fruits. Narosa Publ. House, New Delhi.	
Suggested e-resources (Websites/e-books)	1. http://faculty.agron.iastate.edu/madan/Breeding.pdf 2. https://www.intechopen.com/chapters/73489	

Course Code: AE-211	Course Name: Agricultural finance and co-operation	Semester: III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1				4		**B.Sc. (Hon's), Agriculture**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective: To make students fully aware with the agriculture finance and cooperation with intention to train them about the exercise of finance procedures in banking system and also the cooperative credit structure.

Course outcomes: Through this course students will be able to:

CO-1	Describe the main characteristics of the Indian credit system and financial organisations.
CO-2	Understand the roles and goals of both the commercial bank and the central bank.
CO-3	Apply a variety of statistical and monetary approaches to the project's evaluation
CO-4	Examine the cooperative credit structure and profit statement in agriculture-related enterprises.
CO-5	Evaluate the various credit payback options offered by Indiana's banking system.

Teaching Pedagogy:

T1	Activity based learning through Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Assignment
AT1-5	Viva voce examination

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.	Classroom teaching ABL
	Unit – 2 Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India.	Assignment Mid Term examination
	Unit – 3 Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.	Quiz Assignment
	Unit – 4 Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.	ABL Assignment Quiz
	Unit-5 Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.	End term examination ABL Viva Voce

Practical Exercise* (Min-8)	Course Modules	Assessment tools
	19. Estimation of credit requirement of farmers 20. Estimation of repayment plans by using different methods 21. Analysis of net worth statement 22. Preparation and analysis of income statement	Practical Activity Practical Record Viva voce

	23. Analysis of cash flow statement 24. Calculation of break even point 25. Visit to a commercial bank 26. Analysis of progress and performance of cooperatives using published data.	
Resources:	LCD, White Board	
Assignment/ Tutorial:	Students are required to submit one assignment and quiz as a part of their continuous evaluation system.	
List of Assignments	16. Recent development in agricultural credit Preparation and analysis of financial statements – Balance Sheet and Income Statement	
Suggested reading:	**Textbooks:** Johil S.S. and C.V. Moore. 1970. Essentials of Farm Financial Management. Today and Tomorrow Printers and Publishers, New Delhi. 2. John, J. Hamptron.1983. Financial Decision Making: Concepts, Problems and Cases, of India. New Delhi. 3. Mamoria, C.B. and R.D. Saksena. 1973. Co-operatives in India. Kitab Mahal, Allahabad. 4. Mamoria, C.B. and Saxena. Agricultural Problems in India. Kitab Mahal, Allahabad. **Reference Book:** S.Subba reddy, P.Raghu Ram, T.V.Neelakanta sastry and Bhavani Devi. 2019.Agricultural economics.Oxford; 2nd edition.	
Suggested e-resources (Websites/ e-books)	1. https://agricoop.gov.in/sites/default/files/Annexure_Overview.pdf 2. https://www.nabard.org/auth/writereaddata/tender/2501235626trends-and-patterns-in-agriculture-credit-in-india.pdf	

Course Code: STAT-211	**Course Name:** Agri- Informatics	**Semester:** III

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Hons) Ag, STAT**
Curriculum level							Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective: To encourage the exchange of information for development of knowledge, systems and to achieve productive agricultural resource and develop knowledge-based information society with appropriate application of information.

Course outcomes: After completion of course, the student will be able to:

CO-1	Identify the parts of computer and their applications.
CO-2	Describe the computer programming and MS office.
CO-3	Demonstrate the application of MS office for presentation and report writing.
CO-4	Estimate water and nutrient requirements of crop using CSM and IT tools.
CO-5	Evaluate the outcomes of ICT interventions in agriculture.
CO-6	Develop plan for application of agri-informatics approach for solving agriculture-based problems.

Teaching Pedagogy:

T1	Class room teaching Orchard visit Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exam
AT1-2	Seminar Presentation and Report
AT1-3	Assignment
AT1-4	Quiz
AT1-5	Activity Based Learning
AT1-6	Review writing

Prerequisites	**Unit wise contents details**	**Assessment tools**

Course Contents	**Unit-1:** Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types. Applications of MS-Office for creating, Editing and Formatting a document.	Assignment
	Unit-II: Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts, components and creation of web, HTML, XML coding.	ABL activities Quiz Mid term
	Unit-III: e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. ICT for Data Collection, formation of development programmes, monitoring and evaluation of Programmes.	ABL activities
	Unit IV: Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advises, market price, postharvest management etc.	Assignments Quiz Review writing
	Unit-V: Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information. Decision support systems, taxonomy, components, framework, classification and applications in Agriculture, DSS, Agriculture Information/Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.	Assignments Quiz

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Study of Computer Components, accessories. 2. Introduction of different operating systems such as windows, Unix, Linux, Creating, Files & Folders, File Management. 3. Use of MS-WORD and MS Power point for creating, editing and presenting a scientific Document, Handling of Tabular data, animation, video tools, art tool, graphics, template & designs. 4. MS-EXCEL - Creating a spreadsheet. 5. Use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros. 6. MS-ACCESS: Creating Database, preparing queries and reports,	Activity based learning can be given to implement application aspect

	demonstration of Agri-information system. 7. Introduction to World Wide Web (WWW) and its components, creation of scientific website, presentation and management agricultural information through website. 8. Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools. 9. Use of smart phones and other devices in agro-advisory and dissemination of market information. 10. Introduction of Geospatial Technology, demonstration of generating information important for Agriculture.	
Resources:	LCD, Black/White Board, Computer lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. ICT application in nutrient management 2. Remote sensing and GIS in agriculture 3. Smartphone mobile apps in Agriculture 4. ICT in weather forecasting and crop simulation 5. ICT in market regulation 6. Agri-based information systems	
Suggested reading:	**A. Text books:** 1. John Walkenbach, Herb Tyson, Michael R. Groh, FaitheWempen, Microsoft Office 2010 Bible 2. Bangia,Learning Ms Office 2010 3. Prof. Satish Jain and M. Geetha, MS-Office 2010 Training Guide	
Suggested e-resources (Websites/e-books)	1. https://coabnau.in/uploads/1615268907_geospetical.pdf 2. https://www.niti.gov.in/sites/default/files/2021-08/EnhancingTechnology-Use-in-AgricultureInsurance-30-07-21.pdf 3. http://niam.res.in/sites/default/files/pdfs/Use-of-Drone-in-Indian-Agriculture.pdf 4. http://imetsociety.org/wp-content/pdf/vayumandal/2020462/2020462_5.pdf	

Course Code: AENG-211	Course Name: Farm Machinery and Power	Semester: III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Ag), Hons.**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective: For understanding of basic concept of farm machinery and farm power in India, so as to work on farm and guide other farmers to use farm power machineries.

Course outcomes: Through this course students will be able to:

CO-1	Define the farm power sources and describe the different operations in farm machinery
CO-2	Understand the principles of farm machinery management for different soil, crops and operations
CO-3	Calculate the performance of farm machinery under actual field conditions
CO-4	Examine the working principle of different system of tractor & parts of internal combustion engines
CO-5	Evaluate the performance of harvesting, threshing and special equipment for various farm operations.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Midterm Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning

AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field demonstration
AT1-9	Spot identification

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Farm Power in India: Sources (Renewable, Mechanical, Electrical, Animal, Human Power). Engine terminology. Engines- working principles of two stroke and four stroke engines. Air cleaning- cooling and lubrications.	Power and Poster Point Presentation
	Unit – 2 Tractors- Different systems of Tractor, Types and Selection of Tractors, operating cost of Tractor.	Mid Term examination Report writing
	Unit – 3 Tillage implements, primary and secondary tillage implements.	Assignment Field demonstration
	Unit – 4 Implements for inter-cultural operations.	ABL Quiz
	Unit-V Seed drills, Calibration of seed drill, Paddy transplanters, Plant protection equipment, harvesting and threshing equipment.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Study of different components of engines. 2. Study of working of four stroke engines 3. Study of working of two stroke engines 4. Study of M.B. Plough, measurement of Plough size, different adjustments- horizontal and vertical suction. 5. Study of disc plough and also adjustments of disc plough. 6. Study of seed-cum-fertilizer drills: furrow opener, metering mechanism and calibration. 7. Study, maintenance and operation of tractor. Learning of tractor driving. 8. Study of different inter-culture equipments in terms of efficiency. 9. Study of different types of sprayers 10. Study of different types of dusters. 11. Study of rotavator and cultivator.	Practical Activity Practical Record Viva voce Spot Identification
Resources:	LCD, OHP, Black Board, Agricultural Engineering lab, field	

Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	**1.** Calculate the performance of engine. **2.** Calibration of seed drill Calculate the cost of tractor and other field machinery**.**
Suggested reading:	**A. Textbooks:** 1. Elements of Agricultural Engineering, Dr. Jagdishwar Sahay, Standard Publisher Distributor. 2. Farm Power and Machinery, Er. Sanjay Kumar, Kalyani Publication. 3. Farm machinery- An Approach, S.C Jain and Grace Philip. 4. Principles of Agricultural Engineering, Volume -1, TP Ojha and AM Michael, Jain Brothers. **B. Reference books:** 3. Principles of Farm Machinery, RA kepner, Roy Bainer, B.L Barger. 4. Tractors and Their Power Units, John B. Liljedahl, Paul K. Turnquist, David W. Smith, and Makoto Hoki. 5. Handbook of Agricultural Engineering, ICAR, New Delhi. Agricultural Engineering Data Book, CIAE, ICAR, Bhopal.
Suggested e-resources (Websites/e-books)	1. https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-019-0232-1 2. https://hal.science/hal-00930477/document 3. https://link.springer.com/article/10.1007/s43154-022-00080-x http://naas.org.in/spapers/Strategy%20Paper%20No.%2010.pdf

Course Code: HORT-211	**Course Name:** Production Technology for Vegetables and Spices	**Semester:** III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Ag), HORT**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: Teaching the importance and scientific cultivation methods of various vegetable and spice crops.

Course outcomes: Through this course students will be able to:

CO-1	Describe the nutraceuticals values and economic importance of various vegetable and spice crops
CO-2	Classify the vegetable and spice crops based on different parameters
CO-3	Demonstrate nursery raising in various vegetable crops
CO-4	Examine the impact of various biotic and abiotic stress on the productivity of vegetables and Spices
CO-5	Determine the cost of cultivation of different vegetable and spice crops

Teaching Pedagogy:

T1	Class room teaching (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams
AT1-2	Seminar Presentation and Report
AT1-3	Field Visit Report
AT1-4	Quiz
AT1-5	Assignments
AT1-6	Activity Based Learning
AT1-7	Flip Class

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Importance of vegetables & spices in human nutrition and national economy, kitchen gardening.	Class room teaching (Chalk-board) Power Point Presentations
	Unit-II: Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spice, *viz*., Solanaceous crops: Tomato, Brinjal, Chilli, Capsicum, Cucurbitaceous crops: Cucumber, Melons, Gourds, Pumpkin and squash	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: Cole crops such as Cabbage, Cauliflower, Broccoli, Knol-khol and Bulb crops such as Onion, Garlic Bean crop such as French bean, Pea	Class room teaching (Chalk-board) Power Point Presentations
	Unit-IV: Root crops such as Carrot, Radish, Beetroot and Leafy vegetables such as Amaranth, Palak, Perennial vegetables.	Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-V: Tuber crops such as Potato, Taro, Sweet potato and in brief (package of practices summary in tabular format) about Cassava, Colocasia, Elephant Foot Yam (EYM), Yams (*Dioscorea* spp.). Spices crops: Ginger, Turmeric, Coriander, Fenugreek, Fennel, Cumin	Assignments Flip Class/ Seminars Quiz

Practical Exercise*	List of practicals (field/lab exercises)	Assessment tools
	1. Identification of vegetables & spice crops and their seeds. 2. Nursery raising and transplanting 3. Direct seed sowing 4. Study of morphological characters of different vegetables & spices. 5. Intercultural operations: Weeding, Irrigation, Pruning and Training, 6. Fertilizers applications and use of growth regulators 7. Identification of nutrient deficiencies. 8. Physiological disorder 9. Harvest indices and maturity standards, post-harvest handling and storage 10. Economics of vegetables and spices cultivation	Activity based learning can be given to implement application aspect

Resources:	Lab, Garden tools, Planting materials, Design tools, Drawing tools, Nursey management, Seed identification, crop identifications
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. What is nursery? How nursery management is important for vegetable crop production? 2. Enlist the growing media used in nursery management? 3. What is harvesting indices. Discuss about the harvesting index of major 2 vegetable crops?
Suggested reading:	**A. Textbooks:** 1. Text book of vegetables, tuber crops and spices (eds. S. Thamburaj and Narendra singh), I.C.A.R., New Delhi, 2001. 2. Modern technology in vegetable production (P.Hazra, A. Chattopadhyay, K.Karmakar and S.Dutta), New India Publishing Agency, New Delhi, 2011 3. Basics of Horticulture (ed. K.V. Peter), New India Publishing Agency, New Delhi, 2009
Suggested e-resources (Websites/e-books)	1.http://agricoop.gov.in/Documents/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf 2.http://agricoop.gov.in/en/StatHortEst#gsc.tab=0 3.https://shm.uk.gov.in/files/Books/Check_List_of_Commercial_Varieties_of_Vegetables_(pdf_8.22_MB).pdf

Course Code: STAT 211 **Course Name:** Statistical Methods **Semester:** III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Hon's), Agriculture**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective: To provide knowledge of different statistical methods and hands on training for basic statistical tools used in field of agriculture

Course outcomes: Through this course students will be able to:

CO-1	Describe the application and importance of statistics in the field of agriculture
CO-2	Understand the basic concepts of various statistical tools used for agricultural data analysis
CO-3	Calculate the various statistical parameters of given data samples
CO-4	Analyze the significance of various statistical tools results and draw meaningful inference
CO-5	Evaluate the use/role of various statistical software used for agricultural data sets test/analysis

Teaching Pedagogy:

T1	Activity based learning Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Assignment
AT1-4	Viva voce examination

Prerequisites	Module wise details	Assessment tools
Course Contents	Introduction to Statistics and its Applications in Agriculture, Variable statistics, types and sources of data, classification and tabulation of data, Graphical Representation of Data, Measures of Central Tendency,	Classroom teaching ABL
	Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability; Normal, Binomial & Poisson Distributions	Assignment Mid Term examination
	Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation; Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Test for comparison of variance F test, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table.	Quiz Assignment
	Introduction to Analysis of Variance, Analysis of One Way Classification, Experimental designs: Basic concepts and principles	ABL Assignment Quiz
	Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample, Stratified, Systematic and cluster sampling.	End term examination ABL Viva Voce

Practical Exercise* (Min-8)	Course Modules	Assessment tools
	1. Construction of frequency distribution 2. Calculation of measures of central tendency from row and grouped data 3. Calculation of dispersion from row and grouped data 4. Examples of probability 5. Calculate correlation and interpret the results 6. Calculate regression and interpret the results 7. Examples of Testing of Hypothesis 8. Calculate Experimental Design	Practical Activity Practical Record Viva voce
Resources:	LCD, White Board, Computer Lab.	

Assignment/Tutorial :	Students are required to submit one assignment and attend quiz as a part of their continuous evaluation system.	
List of Assignments	4. Examples of Statistical methods 5. List of formulas of Excel used in Statistics	
Suggested reading:	**I. Textbooks:** 4. Gupta, S. C. and Kapoor, V. K. 2014. Fundamentals of Mathematical Statistics. Sultan Chand and sons. New Delhi 5. Gupta, V.,2002. *Comdex Computer Kit*. Dream Tech Press, New Delhi. 6. Fundamentals of Computers. 2011. Pearson Education-ITL ESL, New Delhi **J. Reference books:** 7. Rangaswamy, R.1995. *A Text Book of Agricultural Statistics*. New Age International Publishing Limited, Hyderabad.	

Course Code: CP 211	Course Name: Environmental studies and Disaster Management	Semester: III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hos (per week)	Section (Group)
03	3	2	1				03		**CP 311**
Curriculum level							Information based Practical based	**Student specific course outcome**	To study about environment, ecosystem and different types of environmental pollution. To Study the types of Disasters, causes and impacts.

Objective(s): The purpose of this undergraduate course is to impart basic and key knowledge of environment and ecosystem. This will help students in enhancing their knowledge of biodiversity and its conservation. To Study the types of Disasters, causes and impacts of Disasters, and Case studies of National and Global Disasters.After successful completion of course, the student will able to explore concept of the subject into their respective dimensions.

Course outcomes:

CO1:	Gain knowledge about environment and Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.
CO.2:	To know about Ecosystem and gain knowledge, how biotic components depend upon the abiotic components.
CO.3:	Gain knowledge about the conservation of biodiversity and its importance.
CO.4:	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO.5:	Students are able to learn types of disasters causes and impact of disaster and International strategy for disaster reduction.

Teaching Pedagogy:

T1	Class room teaching (chalk-board and marker- whiteboard) Power Point Presentations
T2	Presentation Assignments Quiz

Assessment tools			
AT1-1	Midterm Exams	AT1-4	Models
AT1-2	Assignment power point presentation	AT1-5	Poster
AT1-3	Quiz	AT1-6	Activity Based Learning

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. e) Food resources. World food problems, Changes caused by agriculture and overgrazing. f) Land resources. Land as a resource, land degradation, man induced landslides, soil erosion.	Quiz
	Unit – 2 Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem Forest ecosystem b. Grassland ecosystem c. Aquatic ecosystems (ponds).	Presentation
	Unit – 3 Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and bio geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	Quiz ABL activities
	Unit – 4 Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy. Water conservation. Environmental ethics: climate change, global warming. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.	Quiz Assignment

	Unit-V Disaster Management: Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, volcanic eruptions, Climatic change: global warming. Man Made Disasters- building fire, forest fire, air pollution, water pollution, deforestation, industrial waste water pollution. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction.	Quiz

Practical Exercise*	Course Modules	**Assessment tools**	**Comments**
Practical Exercise*	8. Describe environmental problems in your locality and suggest a remedy. 9. Choose five common species of Trees/plants from ITM University and list their common names. Describe each plant in terms of its height and leaves. 10. To study the quality of a sample of water collected. 11. Study of a simple ecosystem (pond ecosystem) and description of the biotic and abiotic components of the ecosystem. 12. To segregate domestic waste into biodegradable and non-biodegradable components.	Activity based learning can be given to implement application aspect	All the Practical Exercises when used for evaluating the performance of the students will lead to attainment of CO1, CO2, CO3, CO4 and CO5
References	1. Gupta, J.P. 2009 Environmental studies, Laxmi Pub. Pvt. Ltd. 2. Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd. Bikaner. 3. Bharucha Erach, The Biodiversity of India, Mapin Pub. Pvt. Ltd., Ahemdabad-380, India. 4. Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill 5. Clark R.S. Marine Pollution, Clanderon Press Oxford (TB) 6. Cunningham W.P.2001.Cooper, T.H. Gorhani, E & Hepworth, Environmental encyclopedia, Jaicob Publication House, Mumbai. 7. De. A.K. Environmental chemistry Willey Eastern Limited. 8. Glick, H.P.1993 water in crisis, Pacific Institute for studies in dev, Environment & security, Stockholm Env, Institute, Oxford Univ, Press 473 p. 9. Hawkins R .E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay.K S Yawalkar, 2004.*Vegetable crops in India*. Agri-Horticultural Pub. House. Nagpur. 10. Gupta Harsh K., Disaster Management, Hyderabad University Press. 11. Sethi, V.K., Disaster Management, New Delhi Maxford Books 12. Odum, E.P.1997.Fundamental chemistry, Goel Pub House Meerut.		
Resources:	Board, Power point presentation		
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.		
List of Assignments	**1.** Explain the Water Pollution and case study. **2.** Explain the Air Pollution and case study. **3.** Explain the Noise Pollution and case study.		
Suggested e-resources (Websites/e-books)			

Course Code: AHS-211	Course Name: Live-Stock and Poultry Management	Semester: III

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
4	3	0	1				05		**B.Sc. (Ag), AHS**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To have expertise in different aspects of dairy and poultry farming

Course outcomes: Through this course students will be able to:

CO-1	Describe the principles of Livestock production and management
CO-2	Understand the various concepts and procedures of livestock and poultry management
CO-3	Organize the livestock and poultry farms in sustainable and efficient manner
CO-4	Analyze the various challenges/problems of livestock and poultry management and suggest the appropriate solution for them
CO-5	Evaluate the impact of livestock and poultry on sustainable integrated farming systems

Teaching Pedagogy:

T1	Class room teaching (chalk-board)
T2	Power Point Presentations
	ABL activities
	Assignments
	Flip Class/ Seminars
	Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Assignments
AT1-6	Activity Based Learning
AT1-7	Flip Class
AT1-8	Review writing

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Role of live-stock in the national economy. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.	Class room teaching (chalk-board) Power Point Presentations
	Unit-II: Management of calves, growing heifers and milch animals. Digestion in livestock. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock. Feed supplements and feed additives. Feeding of live-stock.	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: Incubation, hatching and brooding. Management of growers and layers. Digestion in poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for poultry. Feed supplements and feed additives. Feeding of poultry.	Class room teaching (chalk-board) Power Point Presentations
	Unit-IV: Housing principles, space requirements for different species of livestock and poultry.	Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-V: Introduction of live-stock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.	Assignments Flip Class/ Seminars Quiz Industrial Visit

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Familiarizing with body points/parts of different domesticated animals and poultry. 2. Approaching, handling methods of restraining. 3. Identification methods of farm animals and poultry (branding, tattooing, notching & tagging). 4. A visit to the live-stock and poultry farms. 5. Identification of various breeds and familiarizing with various farm routines and farm records. 6. Judging of cattle, buffalo and poultry. 7. Culling of live-stock and poultry. 8. Layout plans for different live-stock and Poultry houses. 9. Computation of rations for live-stock and Poultry. 10. Formulation of concentrate mixtures and Poultry.	Activity based learning can be given to implement application aspect

	11. Clean milk production and milking methods. 12. Hatching equipment Hatchery operations and incubation.	
Resources:	LCD, OHP, Black Board, live-stock and poultry farms, Hatching equipment	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	▪ Define Livestock? Discuss its role in Indian Economy. ▪ Classify feed stuffs for livestock. Explain the leguminous succulent forages in detail. ▪ How will you define balanced ration. Prepare a list of essential and critically essential amino acid in poultry ration. ▪ Explain different types of poultry farm. What are the advantages and disadvantages of intensive poultry system? ▪ Define vaccination. Explain special precautions for live viral vaccines.	
Suggested reading:	**A. Textbooks:** Prasad J. (2003): Live Stock Production and Management. Banerjee G.C. (2002): Textbook of Animal Husbandry. ICAR (2012): A Handbook of Animal Husbandry.	
Suggested e-resources (Websites/e-books)	1. https://dahd.nic.in/sites/default/filess/livestock%20%205_0.pdf 2. https://dahd.nic.in/sites/default/filess/extensionpublicityfiles/poultry-entrepreneurship-schem-english.pdf 3. https://www.nabard.org/auth/writereaddata/tender/1310223010paper-7-livestck-dr-birthal.pdf 4. https://www.taas.in/documents/pub-sp-12.pdf	

IV SEMESTER

Course Code: AGRON-221	**Course Name:** Crop production technology-II (Rabi)	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hos (per week)**	**Section (Group)**
02	2	1	1		3		**AGRON-221**
Curriculum level					• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective: To learn about the complete cultivation practices, problems and management for the production of rabi crops

Course outcomes: After completion of course, the student will be able to:

CO1:	Describe the basic concepts of cultivation practices and post-harvest technologies of different Rabi crops
CO.2:	Explain steps involved in preparation of field outline, crop production and management
CO.3:	Apply the principles and concepts of agronomy on the field to improve the crop productivity and resource use efficiency
CO.4:	Investigate the role of different agricultural inputs on yield the quality of different Rabi crops
CO.5:	Assess the economic viability of different methods and technologies in different cropping system

Teaching Pedagogy

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools

AT1-1	Midterm Exams	AT1-6	Activity Based Learning
AT1-2	Seminar Presentation and Report	AT1-7	Flip Class
AT1-3	Field Visit Report		
AT1-4	Quiz		
AT1-5	Herbarium file		

Prerequisites	Module wise details	**Assessment tools**
Course Contents	**Unit – 1** Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi cereals crops, *viz*., Wheat and Barley	Class room teaching (chalk-board) Power Point Presentations
	Unit – 2 Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi pulses crops, *viz*., chickpea, Lentil, Peas	Class room teaching (chalk-board) Power Point Presentations
	Unit – 3 Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi oilseeds crops, *viz*., Rapeseed, Mustard and Sunflower	Class room teaching (Chalk-board) Power Point Presentations
	Unit – 4 Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi sugar crop *viz*., Sugarcane	Class room teaching (Chalk-board) Power Point Presentations Assignments Flip Class/ Seminars Quiz Field Visit
	Unit – 5 Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi forage crops *viz*., Berseem, Lucerne and Oat	Class room teaching (Chalk-board) Power Point Presentations Field Visit

Practical Exercise	**Course Modules**	**Assessment tools**

Practical Exercise*	1. Sowing methods of wheat and sugarcane 2. Identification of weeds in rabi season crops 3. Study of morphological characteristics of rabi crops 4. Study of yield contributing characters of rabi season crops 5. Yield and juice quality analysis of sugarcane 6. Study of important agronomic experiments of rabi crops at experimental farms. 7. Study of oil extraction of medicinal crops 8. Visit to research stations of related crops	Activity based learning can be given to implement application aspect
References	1. Bahl, P.N., P.N. Salimath and A.K. Mandal, 1998, Genetics, Cytogenetics and Breeding of crop Plants, Oxford and IBH Publishers & Co., New Delhi. 2. Chopra, V.L. 1994 Plant breeding – Theory and Practices. Oxford and IBH Publishers, New Delhi. 3. Hari, H. R. and Singh, H.G. 2006. Crop breeding and genetics, Kalyani Publishers, New Delhi. 4. Prasad, Rajendra. 2002. *Text Book of Field Crop Production*. ICAR. 5. Singh C, Singh P & Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH. 6. Singh, SS. 1998. *Crop Management*. Kalyani. 7. Yadav DS. 1992. *Pulse Crops*. Kalyani. Panda (2006): Agronomy.	
Resources:	Field Work and visit	
Assignment/ Tutorial:	Students are required to submit one assignment.	
List of Assignments	Full Case study of Rabi crop.	
Projects based learning	1. Establishment of crop cafeteria 2. Agronomy crop museum	

Course Code: AENG-221	**Course Name:** Renewable Energy and Green Technology	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag), HORT**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Wind and Alternative Sources of Energy

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the classification of conventional and renewable Energy sources.
CO-2	Understand the need of renewable energy in agricultural sector.
CO-3	Demonstration the biogas plants and also calculate the capacity of biogas plant.
CO-4	Examine the different solar energy gadgets and their uses.
CO-5	Determine the production process of biofuels, biodiesel, bio-oil and biogas.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL Activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Assignment
AT1-2	Quiz
AT1-3	Mid Term Exams
AT1-4	End Term Exam
AT1-5	Activity Based Learning
AT1-6	Report Writing
AT1-7	Field Trial

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Classification of energy sources, contribution of these of sources in agricultural sector	Assignment Quiz
	Unit – 2 Familiarization with biomass utilization for biofuel production and their application	Mid Term Examination
	Unit – 3 Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, biodiesel and bio-oil production and their utilization as bioenergy resource	Assignments Quiz
	Unit – 4 Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater.	Activity Based Learning Flip Class/ Seminars Quiz
	Unit-V Application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.	Flip Class/ Seminars End Term Examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Familiarization with Renewable Energy Gadgets 2. To Study Biogas Plants 3. To Study Gasifier 4. To Study the Production Process of Biodiesel 5. To Study the Production Process of Bio-Fuels 6. Familiarization with Different Solar Energy Gadgets 7. To Study Solar Photovoltaic System 8. To Study about Solar Lighting 9. To Study about Solar Pumping 10. To Study Solar Cookers	Practical Activity Practical Record Practical and Viva voce Examination
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignme	1. Solar Energy and Its Impact on Environment 2. A World With 100% Renewable Energy	

nts	3. Solar Energy in India and Its Influence on Climate Change 4. Renewable Energy Programs in Developing Countries
Suggested reading:	**A. Textbooks:** 7. Chakraverty, A. 1989. Biotechnology and other alternate technology. Oxford & IBH Publishing Co., New Delhi. 8. Rai, G. D. 1984. Non-Conventional Energy Sources. Khanna Publishers, New Delhi. 9. Vijayalakshmi, Meena Devi, and Nagendra Prasad. 2007. Production of biodiesel from Jatropha carcus oil by using pilot biodiesel plant. AGROBIOS (India), Jodhpur, India. 10. 4. Rai, G. D. 1995. Solar Energy and Its Utilisation. Khanna Publishers, New Delhi. 11. Sukatme, S.P. 1985. Solar Energy. TATA McGraw Hill Publishing Company Limited, New Delhi.
Suggested e-resources (Websites/ e-books)	1. https://isolaralliance.org/uploads/docs/1a08856fdf03457a0b0ee4c5b689de.pdf 2. https://isolaralliance.org/uploads/docs/a15941394105403ec59b9b1e569c7d.pdf

Course Code: HORT-221	**Course Name:** Production Technology for Ornamental Crops, MAP and Landscaping	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag), HORT**
Curriculum level							• Basic, applied and Innovative	**Student specific course outcome**	• Higher Education • Placement • Research • Entrepreneurship

Objective: To educate the production technology for ornamental crops, MAPs and principles landscape designing

Course outcomes: Through this course students will be able to:

CO-1	Identify the different ornamental, medicinal and aromatic plants with their respective uses
CO-2	Understand the basic principles of landscaping used for planning and layout of gardens.
CO-3	Demonstrate various intercultural operations and postharvest practices used in ornamental, medicinal and aromatic crops
CO-4	Analyse the challenges and opportunities in marketing of ornamental, medicinal and aromatic crops produces
CO-5	Determine the cost of cultivation of different ornamental, medicinal and aromatic crops

Teaching Pedagogy:

T1	• Activity based learning using different tools • Flipped classes teaching model • Collaborative learning • Socratic method of teaching. • Power Point Presentations.
T2	• ABL activities • Field demonstration of cultivation practices, • Assignment • Unannounced test • Seminars with open discussions • Group discussions or debate • Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	**Unit wise contents details**	**Teaching Pedagogy**	**Assessment tools**
Course Contents	**Unit – 1** Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.	Socratic method, Presentation	Assignment, Quiz , Mid-term examinations
	Unit – 1I Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Package of practices for loose flowers like marigold and jasmine under open conditions.	Lecture method/ Presentation Field demonstration (ABL)	Skill test , Quiz. end term examinations
	Unit – IV Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium,	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term

	vetiver.;		Examinations
	Unit-V Processing and value addition in ornamental crops and MAPs produce.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	10. Identification of Ornamental and MAP plants. 11. Nursery bed preparation and seed sowing. 12. Training and pruning of Ornamental plants. 13. Planning and layout of garden. 14. Bed preparation and planting of MAP. 15. Protected structures care and maintenance. 16. Intercultural operations in flowers and MAP. 17. Harvesting and post-harvest handling of cut and loose flowers. Processing of MAP. 18. Visit to commercial flower/MAP unit.	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, Horticulture lab and tools, Gardens, and field for demonstration, Polyhouse, Net house, Processing unit/post-harvest lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	6. Preparation of plant identification database for the assign plant species along with identification name plate with In-built barcode 7. Varietal health of ornamental and MAP crops. 8. Value addition process of assign crop	
Suggested reading:	**A. Textbooks:** 4. Randhawa and Mukhopadhay. 2003. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi	

	5. N. Kumar. 2018. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Scientific International Pvt. Ltd., New Delhi. 6. J.S. Arora. 2020. Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi 7. H.C. Srivastava. 2014. Medicinal and Aromatic Plants. ICAR, New Delhi. **B. Reference books:** 6. Chadha, K.L. 2019. Handbook of Horticulture (Vol-I & II). ICAR, New Delhi. 7. C Aswath, T K Bose, L P Yadav, P Pal, K Dutta, Rajiv Kumar and P Das. 2021. Commercial Flowers. Daya Publishing House, New Delhi.
Suggested e-resources (Websites/e-books)	1.http://naac.gov.in/images/docs/campus/Ornamental%20plants%20at%20NAAC.pdf 2.http://agricoop.gov.in/Documents/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf 3.http://agricoop.gov.in/en/StatHortEst#gsc.tab=0 3.https://agriexchange.apeda.gov.in/indexp/genReport_combined.aspx#content

Course Code: SS-321	**Course Name:** Problematic Soils and their Management	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	2	0	0				3		**B.Sc. (Ag), HORT**
Curriculum level							Information based Research based	**Student specific course outcome**	Research Placement Higher education

Objective: To identify the problem and what are the reclamation method requires improving the soil health & improve soil fertility, that necessary to improve the yield.

Course outcomes: Through this course students will be able to:

CO-1	Describe the current scenario of problematic soils in India.
CO-2	Illustrate the processes responsible for the formation of problematic soils
CO-3	Apply remote sensing and GIS techniques for identification, diagnosis and management of problematic soils.
CO-4	Analyse the quality of irrigation water and soil health and its suitability for use in various crops
CO-5	Assess the effects of various reclamation strategies in management of problematic soils

Teaching Pedagogy:

T1	Class room teaching (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation and Report
AT1-3	Quiz
AT1-4	Poster

AT1-5	Activity Based Learning
AT1-6	Assignment
AT1-7	Report writing
AT1-8	Field Visit

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit-I:** Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties.	Assignment Poster
	Unit-II: Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.	Mid Term examination Field visit
	Unit-III: Irrigation water – quality and standards, utilization of saline and brackish water in agriculture.	Class room teaching (Chalk-board) Presentation
	Unit-IV: Remote sensing and GIS in diagnosis and management of problem soils.	Class room teaching (Chalk-board) ABL Quiz
	Unit-V: Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.	End term examination ABL Quiz

Resources:	LCD, OHP, Black Board, Field.
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Role of remote sensing and GIS in diagnosis of problematic soil. 2. Discuss parameter of soil quality and health
Suggested reading:	1. Adams, F.(1984). Soil Acidity and Liming. 2nd Edn, American Society of Agronomy, Madison, U.S.A. 2. Biswas, T.D. and S.K. Mukherjee .1995.Text book of Soil Science. Tata McGraw-Hill Publishing Company Limited, New Delhi. 3. Brady, N.C. and R.R. Well. 2007. The Nature and Properties of soil. 13th edition. Dorling Kindersley

	(India) Pvt. Ltd., New Delhi – 110092 4. Das, D.K. 1997. Introductory Soil Science. Kalyani Publishers, 5. Govt. of India ,1990.Indian agriculture in brief, 23 rd edition, Ministry of Agriculture and Cooperation, New Delhi, pp 160.
Suggested e-resources (Websites/e-books)	1. https://agritech.tnau.ac.in/pdf/3.pdf 2. https://coabnau.in/uploads/1631006625_UG_Ag.Chem.3.3_ProblematicSoils_THEORYNOTES.pdf

Course Code: HORT-221	Course Name: Production Technology of Fruits and Plantation Crops	Semester: IV

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1		3		**B.Sc. (Ag), HORT**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To know importance, different propagation techniques of different fruit and plantation crops.

Course outcomes: Through this course students will be able to:

CO-1	Describe the status and scope of fruit and plantation crops and national and international level
CO-2	Understand the climatic requirement of various fruit and plantation crops.
CO-3	Demonstrate the various intercultural operations practiced in horticultural crops
CO-4	Analyze the role of canopy management for maximising the yield and quality of fruit and plantation crops produces
CO-5	Evaluate the impact of varuous technologies on fruit and plantation production

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam

AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Importance and scope of fruit crops - High density planting - Canopy management- Use of rootstocks in fruit crops. Production technologies of Mango - Botanical name - Family – Origin – Introduction - Varieties – Climate – Soil- Propagation - Planting - Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests - Stem borer - Nut weevil - Fruit fly - Leaf webber - Diseases - Powdery mildew - Anthracnose - Sooty mould - Mango malformation - Physiological disorders-Fruit drop-Alternate bearing- Spongy tissue. Production technology of Banana - Botanical name - Family – Origin - Importance- Varieties – Climate – Soil - Propagation- Planting – Manuring - Irrigation – Inter Cultivation practices – Harvesting – Yield – Pests - Rhizome weevil - Pseudo Stem weevil- diseases - Sigatoka leaf spot - Panama wilt - Rhizome rot - Bunchy top.	Assignment, Quiz , Mid-term examinations
	Unit – 1I Production technology of Citrus (Big Lemon & Malta)- Botanical name – Family - Origin- Introduction - Varieties – Climate – Soil - Propagation - Planting - Manuring - Irrigation – Inter Cultivation – Harvesting – Yield – Pests -Butter fly - Fruit sucking moth – Citrus leaf miner - Diseases – Gummosis – Canker - Tristeza - Physiological disorders - Fruit drop – Granulation. Production technology of Grape- Botanical name- Family- Origin- Introduction - Varieties – Climate – Soil - Propagation- Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests-Flea beetles – Mealy bug - Stem girdler Diseases- Powdery mildew - Downy Mildew – Anthracnose – Physiological disorders- Pink berries. Production technology of Guava and Litchi - Botanical name- Family- Origin- Introduction - Varieties – Climate – Soil- Propagation - Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests of Guava - Tea mosquito bug - Mealybug - Diseases of Guava – Wilt.	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Production technology of Papaya - Botanical name - Family- Origin- Introduction- Varieties – Climate – Soil – Propagation – Planting – Manuring - Irrigation – Inter Cultivation – Harvesting – Yield – Pests – Nematodes - diseases - Powdery mildew - Foot rot – Mosaic. Production technology of Apple, Pear, Peach - Botanical name – Family – Origin –Importance – Varieties – Climate – Soil – Propagation - Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests of Apple - Wooly aphid, Codling moth - Pests of Peach - Fruit Fly - Diseases of Apple- Scab – Powdery mildew- Physiological disorder in apple - Bitterpit - Diseases of Pear- Fruit spot - Diseases of	Skill test , Quiz. end term examinations

	Peach- Leaf curl. Production technology of Minor fruits-, Pomegranate - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield, Pests of pomegranate- Butterfly -Fruit sucking moth; Diseases of pomegranate - Anthracnose and bacterial leaf spot - Physiological disorders of pomegranate - Fruit cracking.	
	Unit – IV Production technology of Jackfruit, Strawberry, Nut crops (Almond & Walnut) - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield – Pests of Jackfruit - Spittle bug - Fruit borer – Diseases of Jackfruit - Rhizopus rot - Die back.	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Plantation crops- Scope and Importance; Production technology of Tea - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield - Processing- Pests of Tea - Tea mosquito bug- Red spider mite - Diseases of Tea - Algal leaf spot- Blister blight.	Seminar Presentation , Unannounced test, End term examination

Practical Exercise*	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Seed propagation-Scarification and stratification of seeds. 2. Propagation methods for fruit and plantation crops. 3. Micro-propagation. 4. Description and identification of fruit crops. 5. Preparation of plant bio regulators and their uses. 6. Pests and diseases of Mango, Banana, Citrus 7. Pests and diseases of Grape, Papaya, guava 8. Pests and diseases of Apple, Pear, Peach. 9. Pests and diseases of Pineapple, Pomegranate, Jackfruit. 10. Pests and diseases of Coconut, Arecanut, Cashew, Rubber 11. Pests and diseases of Coffee and Tea. 12. Physiological disorders of fruit crops – Mango, Citrus, Grape. 13. Physiological disorders of the plantation crops. 14. Visit to commercial plantations/ fruit orchards.	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, Horticulture lab and tools, Gardens, and field for demonstration, Polyhouse, Net house, Processing unit/post-harvest lab	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	17. Preparation of plant identification database for the fruit and plantation crops 18. Varietal health of fruit and plantation crops. 19. Value addition process of assign crop	

Suggested reading:	**A. Textbooks:** 1. Bose, T.K. and Mitra, S.K. 1990; Fruits – Tropical and Sub-tropical; Naya Prakashan, Calcutta. 2. Chattopadhya, P. K. Year; Text Book on Pomology (Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana. 3. N. Kumar. 2018. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Scientific International Pvt. Ltd., New Delhi. **B. Reference books:** 3. Chadha, K.L. 2019. Handbook of Horticulture (Vol-I & II). ICAR, New Delhi.
Suggested e-resources (Websites/e-books)	1. https://agritech.tnau.ac.in/horticulture/pdf/tech_bulletin/national/Checklist_of_CommercialFruits-18-01-13.pdf 2. https://agricoop.nic.in/Documents/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf

Course Code: GPB-221	Course Name: Principles of Seed Technology	Semester: IV

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	2		5		B.Sc. (Ag), HORT
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To impart knowledge on seed Production in relation to seed certification and quality control systems

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe role of quality seed, basic principles and concepts of seed production technology, seed storage, certification and marketing
CO-2	Classify different categories of seed and dormancy and discuss the importance of various field operation used in seed production
CO-3	Demonstrate seed production technology in cereals, oilseed and pulses crop and seed certification process and laws associated with seed legislation
CO-4	Analyze seed health (Purity, viability, germination) and examine the causes and treatment to break dormancy of seed and marketing potential of seed
CO-5	Assess the process seed production of various agricultural crops in different seed production systems and seed quality testing and marketing process
CO-6	Formulate the seed production, storage, certification and marketing strategies for various agricultural crops under the different ecosystems

Teaching Pedagogy:

T1	Class room Lectures/ Guest lectures Laboratory/ Field and lab Practicals Student Seminars/ Presentations
T2	ABL activities Lab and field Tours/ Demonstrations Assignments

Assessment tools	
AT1-1	One Midterm Exam
AT1-2	Seminar, Presentation and Report
AT1-3	Assignment
AT1-4	Activity Based Learning
AT1-5	Preparation of lab test reports (Seed Quality testing)

Prerequisites	Unit wise contents details	Assessment tools

Course Contents	**UNIT-I: Seed and seed technology** introduction, definition and importance. Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed, Deterioration causes of crop varieties and their control.	Assignment Mid term
	UNIT II: Seed production: Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables, GM crops and organic seed production.	ABL activities Mid term
	UNIT III: Seed certification: Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops.	Research field base assignments
	UNIT IV: Seed Processing & Storage – 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.	ABL activities
	UNIT V: Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies	Assignments Presentation/ Seminars

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	Demonstration & Report Preparation 1. Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. 2. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. 3. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. 4. Seed production in important vegetable crops. **Lab Analysis & Report Preparation :** 5. Seed sampling and testing: Physical purity, germination, viability, etc. 6. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. **Field inspection :** 7. Seed certification: Procedure, Field inspection, Preparation of field inspection report. 8. Visit to seed production farms, seed testing laboratories and seed processing plant.	Activity based learning can be given to implement application aspect
Resources:	LCD, Black/White Board, Laboratory, Research field	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Evolution of the Seed Industry in India (History of Seed) 2. Good Characteristic of Seed for higher crop Production and minimization of Source input 3. Differentiate between Hypogeal and Epigeal germination 4. Difference between Orthodox and Recalcitrant Seeds	

Suggested reading:	**A. Textbooks:** 1. Agarwal RL. 2012. Seed Technology. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi. 2. Chakrabarthi SK. 2010. Seed Production and Quality Control. Kalyani Publishers, New Delhi. 3. Mishra DK, Khare D, Bhale MS and Koutu GK. 2011. **B. Reference Book:** 1. Principles of Seed Certification and Testing. Allied Publishers, New Delhi Ramamoorthy K, Sivasubramaniam K and Kannan M. 2006. 2. Seed Legislation in India. Agrobios, Jodhpur, Rajasthan. Renugadevi J, Srimathi P, Renganayaki PR and Manonmani V. 2012. 3. A Handbook of Seed Testing. Agrobios, Jodhpur, Rajasthan. Sharma P. 2008. Seed Legislation. Gene-tech Book Publishers, New Delhi. Trivedi PC. 2011. 4. Seed Technology and Quality Control. Pointer Publications, Jaipur, Rajasthan. Tunwar NS and Singh SV. 2003. 5. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, GOI, New Delhi. 6. Handbook of Seed Certification. Agrobios, Jodhpur, Rajasthan. Neema NP. 1986. 7. Anon. 2016. Manual of Seed Certification Procedures. Directorate of Seed Certification, Coimbatore, Tamil Nadu.
Suggested e-resources (Websites/e-books)	1. www.fao.org 2. www.agri.nic.in 3. www.agricoop.nic.in 4. www.gov.mb.ca 5. www.betterseed.org 6. www.oecd.org/india/ 7. http://www.tnagrisnet.tn.gov.in/ 8. https://pir.sa.gov.au/_data/assets/pdf_file/0003/148134/SeedCertification Manual.pdf 9. http://cms.tn.gov.in/sites/default/files/documents/seed-certification-0.pdf 10. https://seednet.gov.in 11. http://odishaseedsportal.nic.in/SeedPortalData/Resource%20Material/INDIAN-MINIMUMSEED-CERTIFICATION-STANDARDS.pdf 12. https://www.india.gov.in/my-government/documents/e-books 13. https://www.pdfdrive.com/saving-vegetable-seeds-harvest-clean-store-and-plant-seeds-from-your-garden-a-storey-basics-title-d176061376.html 14. https://dl.sciencesocieties.org/publications/books/tocs/cssaspecialpubl/theroleofseedce

Course Code: AGRON-222	Course Name: Farming System and Sustainable Agriculture	Semester: IV

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
1	1	0	0		1		**B.Sc. (Ag),** AGRON
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To impart knowledge to the students on the fundamentals of farming systems and sustainable agriculture.

Course outcomes: Through this course students will be able to:

CO-1	Describe the basic concepts cropping systems and sustainable agriculture
CO-2	Explain the interaction between different farm enterprises
CO-3	Utilize the different concepts of IFS to enhance the crop productivity in sustainable ecosystem
CO-4	Investigate the sustainability of different indicators in various framing system
CO-5	Judge the sustainability of various farming system models in different agro-climatic conditions to get the optimum output of the resources in sustainable manner

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	Assignment Power Point Presentation
AT1-3	Quiz
AT1-4	Activity Based Learning
AT1-5	Poster

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit I:** Farming system-scope, importance, and concept; Types and systems of farming system and factors affecting types of farming.	Assignment Mid term

	Unit II: Farming system components and their maintenance; Cropping system and pattern, 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.	Quiz and Assignment
	Unit III : Sustainable agriculture ,problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability.	Activity Based Learning Assignment
	Unit IV: Integrated farming system, historical background, objectives and characteristics, components of IFS and its advantages, site specific development of IFS model for different agro-climatic zones.	Quiz Assignment
	Unit V: Resource use efficiency and optimization techniques, resource cycling and flow of energy in different farming system, farming system and environment; Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.	Quiz and Assignment

Resources:	Board, Power Point Presentation, Models present in the lab, Demonstration in the laboratory and field.
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Importance of eco-physiology in agriculture. 2. Explain biotic factors. 3. Sources of allelopathic chemicals in crop and weed species. 4. Impact of global warming on climate and agricultural productivity. 5. Effect of pollution on plants and its management. 6. Eco-physiological models for different environmental management.
Suggested reading:	**A. Textbooks:** 1. Arun K. Sharma. 2006. A hand book of organic farming - Agrobios (India) Jodhpur 2. Jayanthi C, Devasenapathy P and Vinnila, C. 2008. Farming systems principles and practice. Satish serial publishing house, Delhi 3. Panda.S.C. 2011. Cropping and farming systems. Agrobios (India) Jodhpur. 4. Ruthenburg, H. 1980. Farming systems in the tropics. Oxford university press.
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/39372/1/IFS_book%20chapter_Retired%20ICAR%20employees.pdf 2. https://www.nature.com/articles/s41598-021-04148-0 3. https://www.icarzcu3.gov.in/book_publications/IFS_NEH_2020.pdf 4. https://onlinelibrary.wiley.com/doi/epdf/10.1002/fes3.321

Course Code: AE- 221 **Course Name:** Agricultural Marketing, Trade and Prices **Semester:** IV

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1				4		**B.Sc. (Ag),**
Curriculum level							• Basic, applied and Innovative	**Student specific course outcome**	• Placement • Research • Higher education • Entrepreneurship

Objective: It is assumed that agricultural marketing includes all of the services required to get an agricultural product from the farm to the consumer. Agricultural production must also be planned, organized, directed, and handled in a way that pleases the farmer, producer, and consumer.

Course outcomes: Through this course students will be able to:

CO-1	Define agricultural marketing methods, along with their pros and cons.
CO-2	Understand the marketing structure of various agricultural input and output with reference to different marketing functions.
CO-3	Compute the marketing profit, pricing spread, producer surplus and efficiency.
CO-4	Analyse marketing functions, market information and market intelligence for improving the producer income.
CO-5	Evaluate the structure and operation of the agricultural marketing channel.

Teaching Pedagogy:

T1	Activity based learning through visit of various fields visit. Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Surplus Calculation
AT1-9	Identification of Market

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.	Presentation
	Unit – 2 Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition-based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits.	Mid Term examination Report writing
	Unit – 3 Marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (AG-mark); 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.	Assignment

	Unit – 4 Costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; **.**	ABL Quiz
	Unit- 5 Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. **.**	End term examination ABL Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Profile Study of a Weekly Market / Visit to A Weekly Market 2. Plotting And Study of Demand and Supply Curves. 3. Study Of Relationship Between Market Arrivals and Prices of Some Selected Commodities 4. Computation Of Marketable and Marketed Surplus of Important Commodities 5. Study Of Price Behaviour Over Time for Some Selected Commodities 6. Identification of marketing channels for selected commodity. 7. Collection of data regarding marketing costs, margins and price spread and presentation of report in the class. 8. Collection of data regarding marketing costs, margins and price spread and presentation of report in the class.	Practical Activity Practical Record Viva voce Identification of channel
Resources:	LCD, OHP, Black Board, Calculation Sheets.	
Assignment/Tutorial:	Students are required to submit two assignment and deliver one power point presentation	

	as a part of their continuous evaluation system.
List of Assignments	1. Write a case study of agro - based industries. Write about various online marketing platform of agriculture products
Suggested reading:	**K. Textbooks:** **1.** Agriculture Marketing – Ramesh Chandra **2.** Agricultural Marketing - Dr. S.N. Pandey, Dr. H.N. Dutta, **L. Reference books:** 4. Agricultural Marketing in India – S. S. Acharya, N. L. Agrawal Agriculture and Food Marketing in Developing Countries by Abbott, John Cave, Oxford, London, 2007
Suggested e-resources (Websites/e-books)	1. https://agmarknet.gov.in/ 2. https://vikaspedia.in/agriculture/market-information/market-information-related-websites 3. http://cacp.dacnet.nic.in/content.aspx?pid=32# 4. http://dmi.gov.in/About.aspx

Course Code: AGRON-223	**Course Name:** Introductory Agro-metrology and Climate Change	**Semester:** IV

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1		3		B.Sc. (Ag), AGRON
Curriculum level					Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective:

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic terminology and definitions in the field of Agro-meteorology
CO-2	Understand the climatic normal, process of weather formation, relationship between weather variables and agriculture.
CO-3	Apply the technics for modification of climate to minimization the losses and improve the crop yield.
CO-4	Analysis the causes of extreme weather conditions and the factors responsible for climate change and global warming.
CO-5	Appraise the impact of particular weather and climate on crop and livestock production.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Introduction: The three spheres of the earth; Terminology and definitions: Meteorology, Climatology, Agrometeorology, Agroclimatology climate and weather - Scope and importance of agrometeorology, Agro- climatic regions of India and Agro-climatic zones of Madhya Pradesh.	Class room teaching (chalk-board) Power Point Presentations
	Unit – 2 Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze.	Assignments And Quiz
	Unit – 3 Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, energy balance of earth.	Class room teaching (chalk-board) Power Point Presentations
	Unit – 4 Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon, mechanism and importance in Indian agriculture; Weather hazards, drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and coldwave.	Assignments And Quiz
	Unit-5 Agriculture and weather relations, modifications of crop microclimate, climatic normals for crop and livestock production; Weather forecasting, types of weather forecast and their uses; Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.	Class room teaching (chalk-board) Power Point Presentations

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Visit of Agrometeorological observatory, site selection of observatory, exposure of instruments and weather data recording. 2. Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law. . 3. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. 4. Measurement of soil temperature. 5. Determination of vapour pressure and relative humidity. 6. Determination of dew point temperature; 7. Measurement of atmospheric pressure and analysis of atmospheric conditions;	Activity based learning can be given to implement application aspect

	8. Measurement of wind speed and wind direction, preparation of windrose. 9. Measurement, tabulation and analysis of rain. 10. Measurement of open pan evaporation and evapo-transpiration, computation of PET and AET.	
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	Agro- climatic regions of India and Agro-climatic zones of Madhya Pradesh. Atmospheric weather variables Climate change and its impact on regional and national Agriculture	
Suggested reading:	**A. Text and Reference books:** 1. Radha Krishna Murthy,V.2016. Principles and practices of agricultural disaster management. B.S Publications, Koti, Hyderabad. 2. Reddy, S.R.2014. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana, Punjab. 3. Radha Krishna Murthy, V. 2002. Basic Principles of Agricultural meteorology. B.S Publications, Koti, Hyderabad.	
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/1870/1/Agro-climatic%20region%20res%20%26%20dev%20planning%20%28central%20plauto-Hill%20region%29.pdf 2. http://www.nicra-icar.in/nicrarevised/images/publications/TDC/Impact%20of%20Climate%20Change%20on%20Indian%20Agriculture%20An%20Agro-Climatic%20Zone%20Level%20Estimation.pdf 3. https://mpsbb.mp.gov.in/mpGlance/agro-climatic.pdf	

Course Code: ELCT FST-221	**Course Name:** Processing Technology of Cereals	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Ag), HORT**
Curriculum level					• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Entrepreneurship • Higher education

Objective: To equip the students processing and product formulation from cereals and millets

Course outcomes: After completion of course, the student will be able to:

CO-1	Memorize the morphology, composition and nutritive value
CO-2	Describe the milling of cereals
CO-3	Demonstrate cereal based processed products
CO-4	Use the cereal-based by-products
CO-5	Analysed cereal based secondary and tertiary processing

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching Power Point Presentations
T2	ABL activities Field demonstration of cultivation practices, Assignment Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Quiz
AT1-4	Activity based learning
AT1-5	Group discussion
AT1-6	Industrial visit
AT1-7	Seminar presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**

Course Contents	**Unit I:** Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value;	Evaluation will be done to understand the students' ability to utilize the skill set learnt. The assessment tools include: Assignment, Presentation, Quiz, Midterm Exams and end term exam, Activity based learning
	Unit II: Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods	
	Unit III: Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking;	
	Unit IV: Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches; Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses;	
	Unit V: Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Morphological characteristics of cereals; 2. Physical properties of cereals; 3. Chemical properties of cereals; 4. Cooking quality of rice; 5. Conditioning and milling of wheat; 6. Production of sorghum flakes and sorghum malt 7. Determination of gelatinization temperature 8. Processing of value added products from millets 9. Visit to Cereal processing unit	Spotting Practical Activity Practical Record Regularity Viva voce
Resources:	LCD, White Board, cereal processing unit	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments		
Suggested reading:	**A. Textbooks:** 1. Amalendu Chakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA. 2. Khalil Khan and Peter R. Shewry. 2009. Wheat: Chemistry and Technology, 4th Ed., AACC International, Inc., St. Paul, MN, USA. 3. Colin Wrigley. 2004. Encyclopedia of Grain Science. Academic Press, London, UK. 4. Elaine T. Champagne. 2004. Rice: Chemistry and Technology, 3rd Ed., AACC International, Inc., St. Paul, MN, USA. 5. Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA. 6. Pamela J. White and Lawrence A. Johnson. 2003. Corn: Chemistry and Technology, 2nd Ed., AACC International, Inc., St. Paul, MN, USA. 7. David A.V. Dendy and Bogdan J. Dobraszczyk. 2001. Cereal and Cereal Products: Technology and Chemistry. Springer-Verlag, US.	

	8. N.L. Kent and A.D. Evers. 1994. Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture, 4th Ed. Elsevier Science Ltd., Oxford, UK. 9. Samuel A. Matz. 1991. The Chemistry and Technology of Cereals as Food and Feed, 2nd Ed. Springer Science + Business Media, NY, USA. 10. E.V. Araullo, D.B. De Padna and Graham. 1976. Rice Post Harvest Technology. IDRC, Canada. 11. Negi H.P.S., Savita Sharma, K. S. Sekhon. Hand book of Cereal technology. Kalyani Pub.
Suggested e-resources (Websites/e-books)	

Course Code: ELCT-GPB-221	**Course Name:** Micro-propagation Techniques	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. (Hons.) Ag**
Curriculum level							Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective: To understand the basic concepts of micro-propagation techniques and their types and Micro-propagation of economically valued crops and to get familiar with the requirements to set up a plant tissue culture laboratory.

Course outcomes: After completion of course, the student will be able to:

CO-1	To understand terminology and definitions related to micro-propagation
CO-2	To acquainted with different micro-propagtion techniques
CO-3	To apply the knowledge for micro-propagation of economically valued crops
CO-4	To get familiar with the requirements to set up a plant tissue culture laboratory
CO-5	To design strategies for commercial exploration of gained knowledge on micro-propagation technology

Teaching Pedagogy:

T1	Class room teaching (chalk-board), Power Point Presentations, Interactive lectures, Inquiry based teaching
T2	ABL activities, Assignments, Flip Class/ Seminars, Quiz, Oral Viva-voce examination

Assessment tools	
AT1-1	Quiz
AT1-2	Activity Based Learning
AT1-3	Midterm Exams
AT1-4	Flip Class
AT1-5	Seminar Presentation
AT1-6	Assignments
AT1-7	Poster
AT1-8	Oral Viva-voce examination
AT1-9	Review writing
AT1-10	Industrial Visit Report

Prerequisites	**Unit wise contents details**	**Assessment tools**

Course Contents	**Unit-I:** Meaning and concept of in vitro culture and micro-propagation; Historical milestones, advancement and future prospects of micro propagation; totipotency, dedifferentiation. Micro-propagation- Definition, methods, stages of micro-propagation and its significance	Quiz Midterm Exam Assignment
	Unit-II: Tissue culture methodology: Sterilization techniques, synthetic and natural media components, growth regulators, environmental requirement, and genetic control of regeneration.	Mid-Term Quiz Assignment
	Unit-III: Plant regeneration pathways-Organogenesis and Somatic embryogenesis; Axillary bud prolife ration approach – Shoot tip and meristem culture.	Mid-Term Oral Viva-voce examination Seminar Presentation
	Unit-IV: Organogenesis-Purpose, methods and requirements for organogenesis, indirect and direct organogenesis; Somatic embryogenesis: Procedures and requirements for organogenesis, indirect and direct embryogenesis.	Quiz Assignment Industrial Visit Report Seminar Presentation
	Unit-V: Differences between somatic and gametic embryogenesis, Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds, Production of secondary metabolites, Somaclonal variations, Cryopreservation	Quiz Assignment Industrial Visit Report Poster Oral Viva-voce examination

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. To understand the different ways of representation of concentration of solutions 2. To get familiar the preparation of different type of solutions 3. Preparation of buffers 4. Estimation of pH 5. Laboratory organization, 6. Sterilization techniques 7. Visit to a plant tissue culture laboratory 8. Preparation and sterilization of growth regulators 9. Experimentation on determining optimum concentration of growth regulators. 10. Callus induction and regeneration of whole plants from different parts of plants 11. Direct regeneration into whole plants using bud, node and other tissues. 12. Induction of somatic embryos 13. Experiments of synthetic seeds production and testing storability and germination efficiency 14. Hardening procedures	Activity based learning can be given to implement application aspect
Resources:	LCD, OHP, Black Board, Laboratory, MS Teams	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of	1. Terminology related to micro-propagation	

Assignments	2. Different type of media and their preparation 3. Sterilization techniques 4. Flow chart of different tissue culture techniques 5. Secondary metabolites production using tissue culture technique
Suggested reading:	**A. Text and Reference books:** • Gamborg, O.L. and Phillips, G.C. 1995. Plant Cell Tissue Organ Culture: Fundamental Methods. Springer, Berlin. • Keshavachandran, R. and Peter, K.V. 2008. Pant Biotechnology: Methods in Tissue Culture and Gene Transfer. Universities Press, Hyderabad. • Smith, R.H., 2013. Plant Tissue Culture : Techniques and Experiments. 3rd ed. Academic Press, San Diego, CA, USA. • Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture, Theory and Practice. Elsevier, Netherlands.1. Gamborg, O.L. and Phillips, G.C. 1995. Plant Cell Tissue Organ Culture : Fundamental Methods. Springer, Berlin. • Keshavachandran, R. and Peter, K.V. 2008. Pant Biotechnology: Methods in Tissue Culture and Gene Transfer. Universities Press, Hyderabad. • Smith, R.H., 2013. Plant Tissue Culture : Techniques and Experiments. 3rd ed. AcademicPress, San Diego, CA, USA. • Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture, Theory and Practice.Elsevier, Netherlands.
Suggested e-resources (Websites/e-books)	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8583726/ 2. https://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-023-04220-z 3. https://www.researchgate.net/publication/233554940_Somatic_Embryogenesis

Course Code: ELCT-HORT-221	**Course Name:** Hi-tech. Horticulture	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				3		**B.Sc. Agriculture**
Curriculum level							• Enhance the ability and skills of students for management of various hi-tech horticulture technology.	**Student specific course outcome**	• Helps to understand the specific technics • Higher education

Objective: To provide opportunity to students for learning different methods and management.

Course outcomes: Through this course students will be able to:

CO-1	Students will be equipped with sufficient theoretical knowledge with practical skills on hi-tech horticulture technology and methods
CO-2	Theoretical knowledge about precision farming and various implements used in nursery preparation.
CO-3	Study about INM & IPM, IWM, protected cultivation, remote sensing and GIS and DGPS.
CO-4	Ability to use techniques and instruments involved in the study of orchard practice equipment
CO-5	Understand the basic practice of nursery preparation and propagation method

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Introduction, importance & scope of hi-tech horticulture in India.	Presentation
	Unit-2 Micro irrigation systems & its components/pH-based irrigation/ fertigation scheduling, Hi-tech canopy management of horticultural crops, High density orcharding in Mango, guava, papaya, citrus, pineapple *etc*.	Mid Term examination Report writing
	Unit – 3 Micropropagation of horticultural crops, hi-tech field preparation and planting methods, Protected cultivation.	Assignment Field trial
	Unit – 4 Remote sensing & geographical information system, Differential geo-positioning system (DGPS), Component of precision farming & application of precision farming in horticultural crops.	ABL Quiz
	Unit-V Importance of INM in horticulture. Micro irrigation – methods, Nursery management in horticultural crops.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	Assessment tools
	1. Identification of protected structure 2. Nursery management of horticultural crops. 3. Micropropagation in horticulture crops 4. Micro-irrigation system 5. H.D.P. of orchard 6. Canopy management of fruit trees 7. EC, ph. Based fertilizer scheduling 8. tools & equipment's identification and use 9. visit to hi-tech orchard/nursery	Practical Activity Practical Record Viva voce Spot Identification
Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Scope of hi-tech horticulture in India 2. Production and productivity of horticultural crops 3. Various technology in horticulture	
Suggested reading:	**A. Textbooks:** 1. Hi-tech Horticulture- T.A.More, MPKV,Rahuri Balraj Singh,2005: Protected cultivation of vegetable crops. Kalyani publication 2. Patil M.T. & Patil, P.V.,2004 Commercial Protected Floriculture.MPKV,Rahuri **B. Reference books:** 1. Commercial floriculture- Prasad & kumar Green house operation & Management: Paul V. Nelson	
Suggested e-resources (Websites/e-books)		

Course Code: ELCT-AE-211	**Course Name:** Agribusiness Management	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Hons.) Ag**
Curriculum level					Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective:

Course outcomes: After completion of course, the student will be able to:

CO-1	Remember various functions of management.
CO-2	Describe agribusiness, its concepts and value addition chain.
CO-3	Apply the knowledge of management functions in establishing and running agribusiness profitably.
CO-4	Analyse agri-business situations, implement plans and manage strategic change.
CO-5	Appraise the projects for their economic feasibility and profitability.
CO-6	Prepare profitable agribusiness projects with capital and market management.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	Assignment Power Point Presentation
AT1-3	Quiz
AT1-4	Economics Models
AT1-5	Activity Based Learning

Prerequisites	**Unit wise contents details**	**Assessment tools**

Course Contents	**Unit-I:** *Management:* Functions, roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control.	Quiz Mid term Assignment exercise
	Unit-II: *Agribusiness:* Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. *Distinctive features of Agribusiness Management:* Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.	Mid term Assignment exercise
	Unit-III: *Agri-value chain:* Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.	Quiz Assignment exercise
	Unit-IV: *Capital Management and Financial management of Agribusiness:* Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, *Product Life Cycle (PLC):*. Sales & Distribution Management. Pricing policy, various pricing methods.	Quiz Economic Model
	Unit-V: *Project Management:* definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques. Undiscounted measures and decision rules. PBP ROR, and discounted measures and decision rules – NPW, BCR, IRR, N/K ratio, Sensitivity analysis.	Activity Based Learning

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Practical Study of agri-input markets: Seed, fertilizers, pesticides. 2. Study of output markets: grains, fruits, vegetables, flowers. 3. Study of product markets, retails trade commodity trading, and value added products. 4. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. 5. Preparations of projects and Feasibility reports for agribusiness entrepreneur. 6. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. 7. Case study of agro-based industries. 8. Trend and growth rate of prices of agricultural commodities. 9. Net present worth technique for selection of viable project. 10. Internal rate of return.	Practical Exercise Viva voce Assignments Presentation
Resources:	Board, Power Point Presentation, practical exercises in the laboratory and its use in the preparation of statements	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Functions of management 2. Project management	
Suggested reading:	**A. Text and Reference books:**	

	1. Aswathappa, K and Sridhar K. Production and Operations Management. 2. David Downey, and John Ericson.Agribusiness Management 3. Gitteger Price, J.1989. Economic Analysis of Agricultural Projects. John Hopkins University Press, London. 4. Harsh, S.B. Conner, U.J. and Schwab G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey, USA. 5. Joseph, L. Massie.1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
Suggested e-resources (Websites/e-books)	1. https://zalamsyah.files.wordpress.com/2018/02/6-agribusiness-management.pdf 2. https://www.manage.gov.in/publications/eBooks/Agri-business%20Management%20Opportunities%20for%20Youth.pdf

Course Code: ELCT-AGRON-221	**Course Name:** Weed Management	**Semester:** IV

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. Ag, AGRON**
Curriculum level					Basic and applied	**Student-specific course outcome**	Higher Education Placement Research

Objective: To impart knowledge of weed management of cereals and pulse crops.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basics concepts of weeds management different weed plants and herbicides along with their respective characteristics & nature
CO-2	Classify and characterized various crop weed plants and herbicides based on different parameters
CO-3	Demonstrate the use of different methods and technology of weed management in the field
CO-4	Investigate the differential effects of various herbicides on different weed plants and examine and cause and management of herbicide resistance
CO-5	Evaluate the integrated weed management (IWM) models in different crops under different crop-weed ecology

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate

AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit I:** Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem.	Quiz Mid-term Exams
	Unit II: classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant herbicide formulation and their use.	**group discussion,** Unannounced test Mid-term Exams
	Unit III: Introduction to mode of action of Herbicides selectivity. allelopathy and its application for weed management.	**assignment and class discussion,** Mid-term Exams and end term exam
	Unit IV: Bío-herbicides and their application in agriculture. concept of herbicide mixture and utility in agriculture Herbicide compatibility with agro-chemicals and their application.	Extempore, Mid-term Exams and end term exam
	Unit V: Integration of herbicides with non-chemical methods of weed management and its management. Herbicide resistance and its management.	PPT Presentation, Mid-term Exams and end term exam

Practical Exercise* **(Min-8)**	**List of practicals (field/lab exercises)**	**Assessment tools**
	• Techniques of weed preservation. • Weed identification and their losses Study. • Biology of important weeds. • Study of herbicide formulations mixture of herbicides. • Herbicide and agro-Chemical study. • Shift of weed flora Study in long-term experiments. • Study of methods of herbicide application, Spraying equipment. • Calculations of herbicide doses and weed control efficiency and weed index.	Spot Identification Practical Activity Practical Record Attendance Skill test Viva voce
Resources:	LCD, OHP, Black Board, Agronomy lab and tools and field for demonstration	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	• Harmful and beneficial effects of weeds • Management of problematic weeds.	

	• Herbicide classification.
Suggested reading:	**A. Text and Reference books:** Weed Management Handbook: Naylor, Robert E. L. A Text Book Of Weed Management Weeds And Their Control Methods: B. L. Jana. Weed Management: U. S. Walia.
Suggested e-resources (Websites/e-books)	1. https://www.isws.org.in/IJWSn/Default.aspx?Issueid=102 2. https://www.researchgate.net/publication/351096525_Weed_Management_Lecture_Note 3. https://www.isws.org.in/IJWSn/File/2010_42_Issue-3&4_123-135.pdf 4. https://www.intechopen.com/online-first/86273 5. https://www.mdpi.com/2073-4395/10/9/1264

Course Code: ELCT-AENG-221	**Course Name:** Remote Sensing and GIS Applications	**Semester: IV**

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Ag)**
Curriculum level					• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective: This course is aimed at understanding the basic concepts of remote sensing, aerial photographs and imageries, and their interpretation; application of remote sensing in general and with special reference to soil, plants and yield forecasting; to impart knowledge about geo-statistical techniques with special reference to krigging, and GIS and applications in agriculture.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the fundamental concept of remote sensing.
CO-2	Discuss the application of remote sensing in agriculture.
CO-3	Apply image processing techniques for identification of crop and soil issues.
CO-4	Examine the Crop stress and Yield forecast of different agricultural crops
CO-5	Determine the GIS techniques for solving complex agricultural problems.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning
AT1-7	Flip Class
AT1-8	Review writing

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources;	Class room teaching (chalk-board) Power Point Presentations
	Unit-II: electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast;	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; .	Class room teaching (chalk-board) Power Point Presentations
	Unit-IV: satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing.	Assignments Flip Class/ Seminars Quiz
	Unit-V: GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	Assignments Flip Class/ Seminars Quiz

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Familiarization with remote sensing and GIS hardware; 2. use of software for image interpretation; 3. interpretation of aerial photographs and satellite imagery; 4. basic GIS operations such as image display; 5. study of various features of GIS software package; 6. scanning, digitization of maps and data editing; 7. Data base query and map algebra.	Activity based learning can be given to implement application aspect

	8. GIS supported case studies in water resources management.	
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Remote sensing and its components 2. Image processing and interpretation 3. Prioritization of watershed. 4. Radiation laws 5. GIS and its components 6. Application of Remote sensing in agriculture	
Suggested reading:	**A. Text and Reference books:** 1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu. 2. Elangovan K. 2006. GIS Fundamentals, Applications and Implementations. New India Publ. Agency. 3. Lillesand TM & Kiefer RW. 1994. Remote Sensing and Image Interpretation. 3rd Ed. Wiley. 4. Nielsen DR & Wendroth O. 2003. Spatial and Temporal Statistics. Catena Verloggmbh. 5. Star J & Esles J. 1990. Geographic Information System: An Introduction. Prentice Hall.	
Suggested e-resources (Websites/e-books)	1. https://www.intechopen.com/chapters/83417 2. https://www.mdpi.com/2072-4292/12/19/3136 3. https://www.ncfc.gov.in/publications/p3.pdf 4. https://www.nrsc.gov.in/sites/default/files/pdf/ebooks/Chap_1_Agriculture.pdf	

V SEMESTER

Course Code: AGRON 312	**Course Name:** Practical Crop Production-I (Kharif Crops)	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	0	0	2				4		**B.Sc. (Ag), AGRON**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To impart technical skills on various crop production technologies through hands on training (Learning-by-doing).

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts and principles of crop production, management and protection
CO-2	Illustrate the conventional practices and novel technological advances in the field of crop production, seed production and crop protection
CO-3	Utilize the conventional and novel technologies in field to achieve high economic return in sustainable manner
CO-4	Analyse the impact of various intercultural operation, technological intervention on yield and quality in different kharif crops
CO-5	Assess the sustainability of various crop production technologies for commercial crop production and quality seed production with better cost benefit ratio

Teaching Pedagogy:

T1	On field Instruction Activity based learning using different tools Collaborative learning Field demonstration of cultivation practices
T2	Assignment Group discussions or debate Learning-by-doing

Assessment tools	
AT1-1	Field performance
AT1-2	Assignment
AT1-3	Report writing

AT1-4	Presentation
AT1-5	Attendance
AT1-6	Viva voce

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.	Field performance, Report writing, Presentation, Attendance Viva voce
Resources:	LCD, Agronomy lab, field for crop cultivation	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Advances in Crop Production and Climate Change 2. New approaches to improve crop tolerance to biotic and abiotic stresses 3. Zero Budget Natural Farming: A way Forward towards Sustainable Agriculture 4. Integrated Nutrient Management in different Kharif Crops 5. Integrated Weed Management in different Kharif Crops 6. Integrated plant disease management (IDM) in different Kharif Crops 7. Integrated Insect Pest Management in different Kharif Crops	
Suggested reading:	**A. Textbooks:** 1. Dr. Rajendra Prasad "Textbook of field crop production" 2019. 2. Chhidda Singh "Raising of field crops" 2018. 1. Dr. S.K. Taunk , Dr. J.L. Choudhary Dr. G.S. Tomar . 2011. Science of Crop Production Vol 1: Kharif Crops Paperback . Kushal Publications and Distributors. 2. Arya R. L., Arya Keshav, Dev Karan, Jatav A. L. 2016. Kharif Crop-Production. Kalyani Pub., Ludhiana.	
Suggested e-resources (Websites/e-books)	1. https://www.ceew.in/sites/default/files/CEEW_ZBNF_Issue_Brief_2nd_Edition_19Sep18.pdf 2. https://www.mdpi.com/2071-1050/14/3/1689 3. https://www.intechopen.com/chapters/64227 4. https://link.springer.com/article/10.1007/s13593-023-00884-x 5. http://www.iiwm.res.in/pdf/Bulletin_69.pdf 6. https://icar-nrri.in/wp-content/uploads/2019/08/11.-NRRI-Research-Bulletin-9.pdf 7. http://oar.icrisat.org/11078/1/Pigeonpea%20hybrid%20%26%20Seed%20Production.pdf 8. https://link.springer.com/book/10.1007/978-981-19-5888-5	

Course Code: PP- 312	Course Name: Principles of Integrated Pest and Disease Management	Semester: V

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1		3		B.Sc. (Ag), PP
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To study the concepts & principles of integrated pest & disease management in crop production

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts and principles of integrated pest and diseases management
CO-2	Identify the different pest and diseases in crop plants
CO-3	Demonstrate the effectiveness of different component of IPDM
CO-4	Investigate the occurrence and forecasting of Insect-pests and diseases
CO-5	Evaluate the suitability of modules of IPDM in different environmental conditions

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Assignment power point presentation
AT1-3	Quiz
AT1-4	Models
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis.	Quiz Assignment
	Unit – 1I Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level.	Quiz, ABL activities
	Unit – III Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment.	Quiz Assignment
	Unit – IV Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases.	Quiz Assignment
	Unit-V Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes	Quiz Assignment

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Methods of diagnosis and detection of various insect pests, and plant diseases 2. Methods of insect pests and plant disease measurement, 3. Assessment of crop yield losses. 4. Calculations based on economics of IPM 5. Identification of biocontrol agents, different predators and natural enemies. 6. Mass multiplication of Trichoderma 7. Mass multiplication of Pseudomonas, 8. Mass multiplication of Trichogramma 9. Mass multiplication of NPV etc. 10. Identification and nature of damage of important insect pests and diseases and their management 11. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. 12. Plan & assess preventive strategies (IPM module) and decision making. 13. Crop monitoring attacked by insect, pest and diseases. 14. Awareness campaign at farmers' fields.	Activity based learning can be given to implement application aspect

Resources:	Board, Power point presentation
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Discuss what IPM is and why it is effective and enhances agricultural resilience 2. Describe factors that contribute to pests evolving resistance to pest control strategies 3. Describe factors that contribute to pests evolving resistance to pest control strategies
Suggested reading:	**A. Textbooks:** 1. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers, Ludhiana 2. Metcalf, R.L. and Luckman, W.H.1982. Introduction to insect pest management Wiley inter science publishing, New York. 3. Larry P Pedigo 1991. Entomology and pest management, Prentice Hall of India Pvt. Ltd., New Delhi 4. Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu,V.G. and Savithri,P.2004.Integrated Insect Pest Management, Agrobios (India) Limited, Jodhpur. 5. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136. 6. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd. New Delhi 7. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publishing Co.Pvt. Ltd.,New Delhi. 8. Vidyasekharan,P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi 9. Y.L. Nene and P.N. Thaplial, 1993, Fungicides in Plant Disease Control. Oxford & IBH Publishing Co.
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/800/1/wsp11.pdf 2. https://krishi.icar.gov.in/jspui/bitstream/123456789/4517/1/Integrated%20Pest%20and%20Disease%20Management%20in%20Groundnut-English.pdf 3. https://agricoop.nic.in/sites/default/files/ICAR_7.pdf 4. https://epubs.icar.org.in/index.php/IndFarm/article/view/48734/20888 5. https://farmer.gov.in/imagedefault/ipm/citrus.pdf 6. https://niphm.gov.in/IPMPackages/Rice.pdf 7. https://www.midh.gov.in/technology/IPM-Schedule-for-vegetables.pdf 8. https://agricoop.gov.in/sites/default/files/Ready-reckoner-PP-I.pdf 9. https://www.manage.gov.in/publications/edigest/jun2019.pdf 10. https://core.ac.uk/download/pdf/211008735.pdf

Course Code: SS-311	**Course Name:** Manures, Fertilizers and Soil Fertility Manageme	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				3		**B.Sc. (Ag), HORT**
Curriculum level							• Information based • Research based	**Student specific course outcome**	• Research • Placement • Higher education

Objective: To improve the soil quality and soil health by using different types manures and fertilizer and integrated soil fertility management aims at maximizing the efficiency of the agronomic use of nutrients and improving crop productivity

Course outcomes: Through this course students will be able to:

CO-1	Describe different types of manures and fertilizers
CO-2	Understand the use of different types of manures and fertilizers in soil fertility management
CO-3	Estimate the content of major essential plant nutrients in soil and plant samples
CO-4	Examine the deficiency and toxicity symptoms of essential plant nutrients
CO-5	Justify the role of integrated nutrient management practices in maintaining the soil health in sustainable manner

Teaching Pedagogy:

T1	Class room teaching, Lab Experiments (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation and Report
AT1-3	Quiz

AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Industrial Visit
AT1-9	Assignment

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit-I:** Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.	Assignment Poster
	Unit-II: Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.	Mid Term examination Industrial visit
	Unit-III: History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.	Class room teaching (Chalk-board) Presentation
	Unit-IV: Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil.	Class room teaching (Chalk-board) ABL Quiz
	Unit-V: Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. 2. Estimation of soil organic carbon 3. Estimation of alkaline hydrolysable N in soils. 4. Estimation of soil extractable P in soils 5. Estimation of exchangeable K; Ca and Mg in soils. 6. Estimation of soil extractable S in soils 7. Estimation of DTPA extractable Zn in soils. 8. Estimation of N in plants. 9. Estimation of P in plants 10. Estimation of K in plants. 11. Estimation of S in plants	Practical Activity Practical Record Viva voce Spot Identification Field Visit
Resources:	LCD, OHP, Black Board, Soil science Lab, Fertilizer unit.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Role, deficiency and toxicity symptoms of essential plant nutrients. Explain chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients	
Suggested reading:	*1. Gupta, P.K. (1999) Hand book of Soil, Fertilizer and Manure. Agro Botanica, Bikaner* *2. Burges, A, and Raw, F. 1967. Soil Biology. Acad.Press, New York* *3. Singh,S.S.2011.Soil Fertility andNutrient Management.3rd Edn. Kalyani Publishers.New Delhi* *4. Tisdale,S.L., Nelson,W.L.,Beaton, J.D. and Havlin,J.L. 1995. Soil Fertility and Fertilisers. 5th Edn. Macmillan publishing company, USA.* *5. Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI New Delhi, 2002*	
Suggested e-resources (Websites/e-books)	1. https://coabnau.in/uploads/1627800020_AG.CHEM.3.2_MANURES,FERTILIZERSANDSOILFERTILITYMANAGEMENT.pdf 2. http://cattheni.edu.in/wp-content/uploads/2018/09/SAC-301.pdf	

Course Code: ENT-311	Course Name: Pests of Crops and Stored Grains and Their Management	Semester: V

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		B.Sc. (Ag), HORT
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To know about host range, identification, biology, nature of damage and management practices of major pests in various crops including stored grains

Course outcomes: Through this course students will be able to:

CO-1	Familiarized with identification of different insect pest of field, horticulture, ornamentals, vegetables and stored grains at the field level.
CO-2	Understand how insects affect animal and Plant health and agricultural production, and be able to safely manipulate populations of beneficial and destructive species in habitats and in production agro-ecosystems with minimal environmental impact.
CO-3	To be able about the biology, diversity, distribution of insects, and their relationships to crop and the environment condition of a particular area
CO-4	To understand identification of nature of damage and symptoms caused by the pest so suitable technique of pest management can be apply for effective control.
CO-5	Management of crop pest through Integrated Pest Management approach without side effect on plant, animal and environment health

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Assignment power point presentation
AT1-3	Quiz
AT1-4	Models
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** General account on nature and type of damage by different arthropods pests. In general study of Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod.	Quiz Assignment
	Unit – 2 Pests of various field crop, cereals and oil seeds Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod	Quiz, ABL activities
	Unit – 3 vegetable crop, Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod	Quiz Assignment
	Unit – 4 Fruit crop, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod	Quiz Assignment
	Unit-V Mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.	Quiz Assignment

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	15. Identification of different types of damage 16. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. 17. Identification of insect pests and Mites associated with stored grain 18. Determination of insect infestation by different methods 19. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. 20. 6. Identification of rodents and rodent control operations in godowns.	Activity based learning can be given to implement application aspect

	21. Determination of moisture content of grain. Methods of grain sampling under storage condition	
Resources:	Board, Power point presentation	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. General account on nature and type of damage by different arthropods pests. 2. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests 3. scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments 4. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain 5. Storage structure and methods of grain storage and fundamental principles of grain store management.	
Suggested reading:	**Textbooks:** 1. B. Vasantharaj David and V.V. Ramamurthy, "Elements of Economic Entomology", 2016. 2. K.P. Srivastava and G.S. Dhaliwal, "A Text book of Applied Entomology Volume II", 2013.	
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/31390/1/Post-Harvest%20Stored%20Product%20insects%20and%20their%20management.pdf 2. https://ncipm.icar.gov.in/ncipmpdfs/Publication/NICRA@NCIPM-Book.pdf	

Course Code: PP-311	**Course Name:** Diseases of field and Horticultural Crops and their Management-I	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
03	3	2	1				04		**B.Sc. (Ag), Plant Pathology**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective: To provide the comprehensive knowledge of the skills and practical experience in disease identification, diagnosis, and management of diseases in field and horticultural crops, and prepare them to make informed decisions and implement sustainable disease management strategies in agricultural production systems.

Course outcomes: Through this course students will be able to:

CO-1	Describe the types of symptoms produced by Fungal, Bacterial, viral and Phytoplasmal pathogens on field and horticultural crops.
CO-2	Identify the different types of pathogens and their etiology associated with field and horticultural crops.
CO-3	Demonstrate the disease cycle and favourable condition for development of diseases
CO-4	Investigate the management practices for major diseases of field and horticultural crops.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination

AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit-I:** Symptoms, etiology, disease cycle and management of following diseases: **Rice:** Blast, Brown spot, Bacterial blight, Sheath blight, False smut, Khaira and Tungro; **Maize:** Stalk rots, Downy mildew, Leaf spots; **Sorghum:** Smuts, Grain mold and Anthracnose, **Bajra**: Downy mildew and Ergot	Presentation
	Unit-II: Symptoms, etiology, disease cycle and management of following diseases: **Groundnut:** Early and Late leaf spots, Wilt; **Soybean:** Rhizoctonia blight, Bacterial spot, Seed and seedling rot and Mosaic; **Pigeonpea:** Phytophthora blight, Wilt and Sterility mosaic; **Finger millet:** Blast and Leaf spot	Mid Term examination Report writing
	Unit-III: Symptoms, etiology, disease cycle and management of following diseases: **Black & Green gram:** Cercospora leaf spot and Anthracnose, Web blight and Yellow mosaic; **Castor:** Phytophthora blight; **Tobacco:** Black shank, Black root rot and Mosaic	Assignment Field trial
	Unit-IV: Symptoms, etiology, disease cycle and management of following diseases: **Guava:** Wilt and Anthracnose; **Banana:** Panama wilt, Bacterial wilt, Sigatoka and Bunchy top; **Papaya:** Foot rot, Leaf curl and Mosaic, Ring spot; **Pomegranate:** Bacterial blight	ABL Quiz
	Unit-V: Symptoms, etiology, disease cycle and management of following diseases: **Cruciferous vegetables:** Alternaria leaf spot and Black rot; **Brinjal:** Phomopsis blight, Fruit rot and Sclerotinia blight; **Tomato:** Damping off, Wilt (bacterial and fungal), Early and Late blight, Buck eye rot, Leaf curl and mosaic; **Okra:** Yellow Vein Mosaic, Powdery Mildew; **Beans:** Anthracnose and Bacterial blight; **Ginger:** Soft rot; **Colocasia:** Phytophthora blight; **Coconut:** Wilt and Bud rot; **Tea:** Blister blight; **Coffee:** Rust	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Identification of different equipment's and glassware's used in Plant Pathology Laboratory 2. Visit to field for diagnosis of different diseases of field crops 3. Visit to field for diagnosis of different diseases of horticultural crops. 4. Preparation of different types of media. 5. Isolation of pathogens associated with plant diseases 6. Cultural and morphological identification of plant pathogens 7. Histo-pathological studies of diseases.	Practical Activity Practical Record Viva voce Spot Identification

	2. To study about the management practices of diseases. 3. Collection and preservation of plant diseased specimens for herbarium.	
Resources:	LCD, OHP, Black Board, Plant Pathology Laboratory.	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Processes of identification of different plant disease. 2. Identification of fungal disease in plant. 3. Identification of different bacterial disease in plant. Identification of different vector-based disease in plant.	
Suggested reading:	**Textbooks:** 1. Rangaswami, G &Mahadevan, K.2001. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd, New Delhi. 2. Pathak, V.N.2001. Diseases of Fruit crops. Oxford & IBH Publications, New Delhi 3. Singh, R.S.1999. Diseases of Vegetable crops. Oxford & IBH Publications, New Delhi **4.** Chaube, H.S and V.S. Pundhir, 2012. Crop Diseases & Their Management. PHI Pvt.Ltd, New Delhi. **Reference books:** 1. George N. Agrios. 2005. Plant Pathology 5th Edition, Academic Press University of Florida, Gainesville, U.S.A. 2. Singh, R.S.2005. Plant Diseases. Oxford & IBH Publications, New Delhi	
Suggested e-resources (Websites/e-books)	1. https://apsjournals.apsnet.org/toc/pdis/current 2. https://agrimoon.com/wp-content/uploads/Diseases-of-Field-Crops-and-Their-Management. 3. https://www.iaritoppers.com/2019/06/Disease-Of-Horticultural-Crops-and-Their-Management-ICAR-E-course	

Course Code: GPB-311	**Course Name:** Crop Improvement - I (Kharif Crops)	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1		3		**B.Sc. (Ag), GPB**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To provide insight into crop improvement strategies of different kharif crops using conventional and modern innovative approaches.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe basic concepts of various methods and technologies used in crop improvement
CO-2	Explain the various procedures used for PGR conservation, transfer of traits of interest and advance technologies used for seed production in different kharif crops
CO-3	Utilize the crop improvement concepts and principles for developing improved varieties, F1 hybrids and advance breeding lines
CO-4	Investigate the suitability of different methods and technologies for the particular traits depending upon gene action, inheritance pattern and nature of donor parents
CO-5	Assess the breeding behaviour of various breeding population along with their maintenance strategies
CO-6	Formulate the breeding strategies for transferring gene of interest from different gene of various biotic and abiotic stress and quality traits

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; gene pool, bridge species	Quiz , Mid-term examinations, Assignment
	Unit-II: Plant genetic resources: exploration, utilization and conservation, study of genetics of qualitative and quantitative characters; wide hybridization, somatic hybridization, embryo rescue techniques, Somaclonal variation	Assignment, Unannounced test Mid and End Term Examinations
	Unit-III: Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops; Variety Development systems and Maintenance, DUS (NDUS) testing: Procedure of DUS characterization, DUS Descriptors for major crops	Quiz. end term examinations
	Unit-IV: Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic (drought, heat and salinity) and biotic stress tolerance and quality (physical, chemical, nutritional), Allele mining, Marker-assisted breeding, speed breeding, reverse breeding, shuttle breeding, root stock breeding, doubled haploid (DH) technology, Biofortification in crops	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V: Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, *etc*. Schemes for development and maintenance of A, B, and C/R lines in different male sterility systems. Strategies for the development and maintenance of self-incompatible and gynoecious lines in. Ideotype concept and climate resilient crop varieties for future.	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice/Maize/Sorghum/Pearl millet/Ragi	Skill test Practical Activity

	2. Floral biology, emasculation and hybridization techniques in different crop species; viz., Pigeonpea/Urdbean/ Mungbean/Soybean/Groundnut/Cowpea 3. Floral biology, emasculation and hybridization techniques in different crop species; viz., Caster, Seasame. 4. Floral biology, emasculation and hybridization techniques in different crop species; viz., Tomato/Brinjal/Tobacco. 5. Floral biology, emasculation and hybridization techniques in different crop species; viz., Brinjal, Okra/Cotton 6. Floral biology, emasculation and hybridization techniques in different crop species; *viz*., Cucurbitaceous crops. 7. Maintenance breeding of different kharif crops. 8. Study of field techniques for seed production and hybrid seeds production in Kharif crops Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters. 9. Genetic variability and diversity analyses using statistical software 10. Mating designs and stability analyses 11. NCBI bioinformatics an introduction to BLAST for biological sequence analyses 12. Visit to seed production plots. 13. Visit to AICRP plots of different field crops.	Practical Record Attendance Seminar Presentation Viva voce
Resources:	LCD, GPB lab, Breeding block (with different breeding populations)	
Assignment/Tutorial :	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	20. Applications of marker assisted selection in crop improvement 21. Recent trends and advances of RNA interference (RNAi) to crop improvement for enhancing resilience to various biotic and abiotic stresses 22. CRISPR/Cas: Gene Editing for Crop Improvement: Paradigm Shift towards Sustainable Agriculture 23. Applications of In Vitro Tissue Culture Technologies *(i.e.,* Embryo Rescue, Somaclonal Variation, *etc*.) in Breeding and Genetic Improvement	
Suggested reading:	**A. Textbooks:** 1. Chopra VL and Prakash S. 2002. Evolution and Adaptation of Cereal Crops. Oxford & IBH. 2. Sharma, AK. 2005. Breeding Technology of Crop Plant. Yesh Publishing House, Bikaner 3. Parthasarathy VA. 2017. Spices and Plantation Crops Vol.1 (Part A) Breeding of Horticultural 4. Crops Vol.1 (Part-B), Today and Tomorrow Printers and Publishers 5. B.D. Singh "Plant Breeding: Principles and Methods" 2015	
Suggested e-resources (Websites/e-books)	1. https://biosafety.icar.gov.in/wp-content/uploads/2015/11/Biology_of_Rice3.pdf 2. https://biosafety.icar.gov.in/wp-content/uploads/2015/11/Biology_of_Cotton6.pdf 3. https://biosafety.icar.gov.in/wp-content/uploads/2015/11/Biology_of_Maize1.pdf	

	4. https://biosafety.icar.gov.in/wp-content/uploads/2016/10/biology_of_cajanus_cajan_pigeon_pea_REVISED-1.pdf 5. https://biosafety.icar.gov.in/wp-content/uploads/2016/10/6_Biology_of_Solanum_lycoperscicum_Tomato.pdf 6. https://www.mdpi.com/1467-3045/45/2/59 7. https://link.springer.com/article/10.1007/s00122-020-03601-4?fbclid=IwAR18XY6GWPlzwTAo2wow7b8v19Jsl72iaapy3r3p23SmYGWh8kYtDf3dIBg 8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8869642/ 9. https://jgeb.springeropen.com/articles/10.1186/s43141-021-00231-1 10. https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0144142&type=printable 11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10005591/ 12. https://www.mdpi.com/2073-4395/13/3/730 13. http://nicra-icar.in/nicrarevised/images/publications/Climate%20Resilent%20Crop_All%20Pages_12-03-19_low.pdf 14. https://iimr.icar.gov.in/wp-content/uploads/2020/12/Biofortified-Varieties-Book_V3_ICAR.pdf

Course Code: AEXT-311 **Course Name:** Entrepreneurship Development and Business Communication **Semester:** V

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hos (per week)	Section (Group)
02	1	0	1		02		**AEXT-221**
Curriculum level					• Information based • Practical based	**Student specific course outcome**	• Placement • Higher education

Course outcomes:

CO1:	Remember the entrepreneurial and managerial attributes.
CO2:	Describe the agri-preneurship, startups and commercialization
CO3:	Apply the knowledge of entrepreneurial and managerial attributes for operating and managing an enterprise.
CO4:	Analyze the emerging domestic and international issues related to agriculture entrepreneurship.
CO5:	Prepare their own project for establishing enterprises as trained entrepreneurs they would not seek the job, but give the job to others.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools			
AT-1	one Midterm Exams	AT-4	Group Discussion
AT-2	Assignment Power Point Presentation	AT-5	Posters
AT-3	Quiz	AT-6	Activity Based Learning

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit-I:** Concept of Entrepreneur, Entrepreneurship, Distinction between an Entrepreneur and a Manager ; Management – Levels & Functions of Management - planning-Organizing -Directing – motivation – ordering – leading – supervision-Communication and control. Characteristics of Entrepreneurs; Opportunities for entrepreneurship and rural entrepreneurship. Types of Entrepreneurs, Functions of Entrepreneurship	Quiz Assignment
	Unit-II Agri –Entrepreneurship - Concept, Need and Scope. Assessing overall business environment in Indian economy; Globalization and the emerging business entrepreneurial Environment.	Quiz Assignment Mid term
	Unit-III: Entrepreneurship Development Programmes (EDPs) – Objectives, Phases, Problems of EDPs, Entrepreneurial behavior and Role of Achievement Motivation, Factors Affecting Entrepreneurship Development; Generation, Incubation and Commercialization of Business Ideas. Environment scanning and opportunity identification, Researching / Managing Competition - Ways to define possible Competitors.	Mid term Assignment
	Unit-IV: Globalization and the emerging business entrepreneurial environment; Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs SWOT Analysis - Concept, Meaning and Advantages. Government Policies, Incentives, Programmes and Schemes for Entrepreneurship Development; Export and Import Policies relevant to Indian Agriculture Sector. Institutional Support - Financial Institutions and other agencies in entrepreneurship development. Venture capital (VC), contract farming (CF) and joint ventures (JV), Public-private partnerships (PPP); Overview of agricultural Input industry – Seed, Fertilizer, Pesticides, Farm Machinery, Agricultural Food Processing Industry.	Group Discussion Poster
	Unit-V: Definition of business; Stakeholders in business; Stages of Indian business; Importance of agribusiness in Indian economy; Business Communication for Public Relation , Advertisement and crisis communication. Social responsibility of business. Morals and ethics in enterprise management Assessment of Entrepreneurship skills, Business Leadership Skills;	Assignment Role play

	Communication Skills for entrepreneurship development, Developing organizational skill, Managerial skills, Problem solving skill and Time management skills.	

Practical Exercise*	Course Modules	**Assessment tools**
Practical Exercise*	1. Field Visits to study any one Agri - based industries / business – Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. 2. Constraints in setting up of agro based industries. 3. Formulation of project feasibility reports; industrial and agribusiness Houses. 4. Characteristics of Successful Agripreneurs, any one of the Local Financial Institutions to study the MSME Policies. 5. Visit to Entrepreneurial Development Institute to study the Process of Entrepreneurship Development. 6. Carrying out the SWOT Analysis of nearby Successful Enterprises. 7. Visit to nearest Agri - Clinic and Agri - Business Centre if any.	Activity based learning can be given to implement application aspect Practical Exercise Viva voce Assignments Presentation
References	1. Anil Kumar, S., Poornima, S. C., Mini, K., Abraham and Jayashree, K. 2003.*Entrepreneurship Development*. New Age International Publishers, New Delhi. 2. Bhaskaran, S. 2014. *Entrepreneurship Development & Management*. Aman Publishing House, Meerut. 3. Gupta, C.B. 2001. *Management: Theory and Practice*. Sultan Chand and Sons, New Delhi. Indu Grover 2008. *Handbook on Empowerment and Entrepreneurship*. Agro-tech Publishing	
Resources:	Board, Power Point Presentation, Models present in the lab, Demonstration in the laboratory and field.	
Assignment/Tutorial:	Students are required to submit one assignment and attend quiz as a part of their continuous evaluation system.	
List of Assignments		

Course Code: AGRON-311	Course Name: Geoinformatics and Nanotechnology and Precision Farming	Semester: V

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1		3		B.Sc. (Ag), AGRON
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To impart knowledge about the Geoinformatics and Nanotechnology and Precision Farming and their applications in agriculture.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basics of geoinformatics and nanotechnology in relation to precision farming
CO-2	Explain about the effective use of inputs result in greater crop yield with good quality without affecting the environment
CO-3	Apply precision agriculture which address both economic and environmental issues that surround production agriculture today
CO-4	Simplify and encourage the farmers to study of special and temporal variability of the input parameters using primary data in field level
CO-5	Judge about the consequences of applying imbalance dose of farm input like irrigation, fertilizer, insecticides and pesticides

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools

AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit-I:** Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture;	Assignment, Mid-term examinations
	Unit-II: Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies;	Assignment, Unannounced test Mid and End Term Examinations
	Unit-III: Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions	Skill test , Quiz. end term examinations
	Unit-IV: Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture;	Assignment, End Term Examinations
	Unit-V: Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.	Seminar Presentation, End term examination

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Introduction to GIS software, spatial data creation and editing and image processing software. 2. Visual and digital interpretation of remote sensing images. 3. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. 4. Multispectral remote sensing for soil mapping.	Practical Activity Practical Record Attendance Viva voce

	5. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. 6. Fertilizers recommendations based of VRT and STCR techniques. 7. Crop stress (biotic/abiotic) monitoring using geospatial technology. 8. Use of GPS for agricultural survey. 9. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.	
Resources:	LCD, OHP, Black Board, Computer lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Precision Agriculture in India: Opportunities and Challenges 2. Applications of Drones in agriculture 3. Space technology support for development of agriculture in India – scope and challenges	
Suggested reading:	**A. Textbooks:** 1. Reddy S.R. 2017. Geoinformatics and Nanotechnology for Precision Farming B.Sc. 6th Sem. Kalyani Pub., Ludhiana. 2. Premjit Sharma. 2007. Precision Farming. Gene-Tech Books. 3. AK Singh and UK Chopra 2007. Geoinformatics Applications in Agriculture. New India Publishing Agency.	
Suggested e-resources (Websites/e-books)	1. https://krishi.icar.gov.in/jspui/bitstream/123456789/35887/1/7.pdf 2. http://14.139.123.73/bhoomigeoportal/publication_pdf/annual_report_publication/14_15.pdf 3. https://ncfc.gov.in/publications/p6.pdf 4. https://www.iirs.gov.in/iirs/sites/default/files/StudentThesis/RIDHIKA_MTech_2013-15.pdf 5. http://nihroorkee.gov.in/sites/default/files/uploadfiles/ILWIS-Training_Final.pdf 6. https://naaccr3.mkce.ac.in/3.7.1.1.274.pdf 7. https://mdpi-res.com/d_attachment/sustainability/sustainability-14-10198/article_deploy/sustainability-14-10198.pdf?version=1660720065	

Course Code: GPB-312	**Course Name:** Intellectual property rights	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	0		1		**B.Sc. (Ag), GPB**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research

Objective: to encourage the creativity of the students through various IPR tools.

Course outcomes: Through this course students will be able to:

CO-1	Define the basic concepts of intellectual property rights and describe different kinds of IPRs
CO-2	Explain the various legal frameworks and instruments related to IPRs
CO-3	Apply the various IPR tools with respect to wealth and value creation in a knowledge based economy
CO-4	Analyse the process of protection of the various kinds of intellectual property (IP) at national and international level
CO-5	Evaluate the impact of National IPR Policy on agricultural research and innovation

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test

AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit – 1** Introduction and meaning of intellectual property. Brief introduction to GATT, WTO, TRIPs and WIPO Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, *etc.*	Assignment Quiz
	Unit – 2 Types of Intellectual Property and legislations covering IPR in India: Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.	Case study Mid term
	Unit – 3 Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.	Activity based learning
	Unit – 4 Origin and history including a brief introduction to UPOV for protection of plant varieties; Protection of plant varieties under UPOV and PPV&FR Act of India; Plant breeders rights; Registration of plant varieties under PPV&FR Act 2001; breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders;	Assignment Quiz
	Unit-5 Convention on Biological Diversity; International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.	Assignment

Resources:	LMS, Black Board, Seminar hall, Library
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Current international and domestic scenario of IPR polices. 2. Protection of Plant Varieties and Farmers Rights Act 2001. 3. Indian Patent Act 1970
Suggested reading:	**A. Textbooks:** 1. Acharya, N.K. 2014. Text book of Intellectual Property Rights. Asia Law House, Hyderabad. 2. Loganathan, E.T. 2012. Intellectual Property Rights. New Century Publications, New Delhi.

	3. Rosedar, S.R.A. 2016. Intellectual Property Rights. Lexis Nexis (2nd Ed.), Nagpur.
Suggested e-resources (Websites/e-books)	1. https://www.meity.gov.in/writereaddata/files/National_IPR_Policy.pdf 2. https://dpiit.gov.in/sites/default/files/Scheme%20IPR%20Awareness.pdf 3. https://www.wipo.int/portal/en/index.html 4. https://www.upov.int/edocs/pubdocs/en/upov_pub_353.pdf

Course Code: ELCT FST-311	**Course Name:** Processing Technology of Fruits and Vegetables	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag), HORT**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To impart comprehensive knowledge on processing of fruits and vegetables

Course outcomes: After completion of course, the student will be able to:

CO-1	State the production, processing status and supply chain of fruits and vegetables
CO-2	Explain the basic processing methods of processing and canning
CO-3	Use the processing methods for formulation of the products from fruits and vegetables
CO-4	Examine the specifications for different processed products formulated by regulatory bodies
CO-5	Judge the Preparation, preservation and machines for manufacturing different processed products

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching Power Point Presentations
T2	ABL activities Field demonstration of cultivation practices, Assignment Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Quiz
AT1-4	Activity based learning
AT1-5	Group discussion
AT1-6	Industrial visit
AT1-7	Seminar presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India. Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables.	The assessment tools include: Assignment, Presentation, Quiz, Midterm Exams and end term exam, Activity based learning, Industrial visit
	Unit-II: Primary processing and pack house handling of fruits and vegetables. Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables. Minimal processing of fruits and vegetables; Blanching operations and equipment. Canning: Definition, processing steps, and equipment, cans and containers, quality assurance and defects in canned products.	
	Unit-III: FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc. Processing and equipment for above products; FSSAI specifications;	
	Unit-IV: Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and marmalades, candies, Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, lather, dehydrated, wafers and papads, soup powders.	
	Unit-V: Production of pectin and vinegar; Commercial processing technology of selected fruits and vegetables for production of various value-added processed products	

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. To Primary processing of selected fruits and vegetables. 2. Preparation of RTS and syrups. 3. Preparation of dried onion. 4. Preparation of pickles. 5. Preparation of pectin. 6. Preparation of jelly 7. Preparation of marmalade 8. Canning of fruits (Mango/Guava/ Papaya) and vegetables 9. Visit to food processing unit	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, Black/White Board, Laboratory, SWAYAM (PEPTL: Post Harvest Operations and Processing of horticultural produce)	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Collection of edible portion while processing 2. Preparation of dried products 3. Quiz	
Suggested reading:	**A. Textbooks:** 1. U.D. Chavan and J.V. Patil. 2013. Industrial Processing of Fruits and Vegetables. Astral International Pvt. Ltd., New Delhi.	

	2. S. Rajarathnam and R.S. Ramteke. 2011. Advances in Preservation and Processing Technologies of Fruits and Vegetables. New India Publishing Agency, New Delhi. 3. Y.H. Hui. 2006. Handbook of Fruits and Fruit Processing. Blackwell Publishing Ltd., Oxford, UK. 4. W.V. Cruess. 2004. Commercial Fruit and Vegetable Products. Agrobios India, Jodhpur. 5. Y. H. Hui, Sue Chazala, Dee M. Graham, K.D. Murrell and Wai-Kit Nip. 2004. Handbook of Vegetable Preservation and Processing. Marcel Dekker, Inc., NY, USA. 6. A.K. Thompson. 2003. Fruit and Vegetables: Harvest, Handling and Storage, 2nd Ed. Blackwell Publishing Ltd., Oxford, UK. 7. Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. 8. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA. 9. R.P. Srivastava and Sanjeev Kumar. 2002. Fruit & Vegetable Preservation: Principles and Practices, 3rd Ed. International Book Distribution Co., Delhi. 10. P.H. Pandey. 1997. Post Harvest Technology of Fruits and Vegetables. Saroj Prakashan, Allahabad. 11. Mircea Enachescu Dauthy. 1995. Fruit and Vegetable Processing. FAO Agricultural Services Bulletin No.119. FAO of UN, Rome. 12. Girdhari Lal, G.S. Siddappa and G.L. Tandon. 1959. Preservation of Fruits and Vegetables. ICAR, New Delhi. 13. EIRI Board of Consultants and Engineers. Manufacture of Snacks, Namkeen, Papads and Potato Products. EIRI, New Delhi.
Suggested e-resources (Websites/e-books)	

Course Code: ELCT-GPB-311	**Course Name:** Commercial Plant Breeding	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	1	0	2		5		**B.Sc. (Ag), GPB**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To educate the students about concept of commercial breeding and major breeding procedures for development of hybrid varieties of various crops.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the breeding techniques for commercial production of seed
CO-2	Classify the seed production systems through the breeding techniques
CO-3	Demonstrate various methods of Commercial breeding techniques at field and laboratory levels
CO-4	Analyse various techniques and the effectiveness of breeding techniques utilized at commercial level.
CO-5	Assess the quality of the seed and Judge the performance of high yielding and resistance varieties of different crops

Teaching Pedagogy:

T1	Class room Lectures/ Guest lectures Laboratory/ Field and lab Practicals Student Seminars/ Presentations
T2	ABL activities Lab and field Tours/ Demonstrations Assignments

Assessment tools	
AT1-1	One Midterm Exam
AT1-2	Seminar, Presentation and Report
AT1-3	Assignment
AT1-4	Activity Based Learning
AT1-5	Preparation of field test reports

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production.	Assignment Mid term
	Unit-II: Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.	ABL activities Mid term
	Unit-III: Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.	Research field base assignments
	Unit-IV: IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India.	ABL activities
	Unit-V: Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.	Assignments Presentation/ Seminars

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	Demonstration & Report Preparation based: 4. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. **Field and Lab based:** 5. Floral biology of self and cross pollinated species, selfing and crossing techniques. 6. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. 7. Role of pollinators in hybrid seed production 8. Learning techniques in hybrid seed production using male-sterility in field crops. 9. Concept of line its multiplication and purification in hybrid seed production 10. Concept of rouging in seed production plot 11. Sampling and analytical procedures for purity testing and detection of spurious seed. 12. Seed drying and storage structure in quality seed management 13. Screening techniques during seed processing viz., grading and packaging. **Field Visit based:** 14. Visit to public private seed production and processing plants. 15. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops	Activity based learning can be given to implement application aspect

Resources:	LCD, Black/White Board, Laboratory, Research field
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	
Suggested reading:	**A. Textbooks:** 1. Agarwal, R.L. 2015. Seed Technology. Oxford and IBH Publication Co., New Delhi. 2. Khare, Dhirendra and Bhala, M.S. 2014. Seed Technology second revised edition. Scientific Publishers. Jodhpur. 3. Phundan Singh, 2014. Essentials of Plant Breeding. Kalyani Publishers, New Delhi. 4. Singh, B.D. 2015. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
Suggested e-resources (Websites/e-books)	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6056351/ 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8502939/ 3. https://link.springer.com/article/10.1007/s00122-019-03433-x

Course Code: ELCT-HORT-311	**Course Name:** Landscaping	**Semester**: V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hos (per week)**	**Section (Group)**
2	2	0	1				4		**B.Sc. (Ag), HORT**
Curriculum level							• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Research • Higher education

Objective:

1. To impart knowledge on the current status and export potential of ornamental crops
2. To inculcate the importance of conserving rare plant spices
3. To discuss the problems in production and marketing of planting material intended for urban planning.

Course outcomes:

CO-1	Define the knowledge on landscape designing.
CO-2	Explain importance of Software based learning of landscape architecture.
CO-3	Demonstrate the various methods/ approaches of Bonsai management.
CO-4	Examine the methods of various lawn management techniques.
CO-5	Evaluate various software for landscape based on performance and designing
CO-6	Develop plan or layout of public and private landscape area.

Teaching Pedagogy:

T1	Class room teaching (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools			
AT1-1	Mid-term Exams	**AT1-6**	Activity Based Learning
AT1-2	Seminar Presentation and Report	**AT1-7**	Flip Class
AT1-3	Field Visit Report		
AT1-4	Quiz		

AT1-5	Assignments		

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit-1: Introductory landscaping** 1. History, scope and opportunities in landscape architecture 2. Terminology associated with landscaping Constrain in landscape designing	Assignment
	Unit-2 Elements and Principles of Landscaping/designing 1. Elements of landscaping and landscape designing 2. Principles of landscaping and landscape designing Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.	ABL activities Mid term
	Unit-3 Types and Style of garden 1. Garden styles and types (Terrace gardening, vertical gardening, garden components,adornments, lawn making, rockery, Water Garden, walk-paths, bridges, other constructed features etc. gardens for special purposes) lawn: establishment and maintenance	ABL activities
	Unit-4 Therapeutic and pharmaceutical uses 1. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous, planting scheme, Perennials, Climber and creepers, Annuals: Importance,selection, propagation 2. Other Garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement	ABL activities And Projects
	Unit-5 CAD- its importance and application 1. History, scope and importance of CAD 2. Advantages and disadvantages of CAD 3. Introduction to AutoCAD and its components 4. Various software used for landscape planning.	Assignments Flip Class/ Seminars Quiz

Practical Exercise*	Course Modules	**Assessment tools**
Practical Exercise*	1. Practical-1: Identification of trees, shrubs, annuals, pot plants 2. Practical-2: Propagation of trees, shrubs and annuals, care and maintenance of plants 3. Practical-3: Identification of tools and implements used in landscape design 4. Practical-4: Training and pruning of plants for special effects 5. Practical-5: lawn establishment and maintenance 6. Practical-6: layout of formal gardens, informal gardens, special type of gardens 7. Practical-7: Designing of conservatory and lathe house 8. Practical-8: Use of computers software, visit to important gardens/ parks/ institutes.	Activity based learning can be given to implement application aspect, Lab work and computer-based work

References	**Prescribed Books:** a) Christine Wein-Ping Yu 1987. Computer-aided Design: Application to Conceptual Thinking in Landscape Architecture. amazon.com b) Bose TK, Maiti RG, Dhua RS & Das, P. 1999. Floriculture and Landscaping. Naya Prokash. **Reference Books:** a) Nambisan KMP. 1992. Design Elements of Landscape Gardening. Oxford & IBH. Randhawa GS & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
Resources:	Lab tools
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	**Assignment:** 1. Importance of landscaping 2. Importance and role of 2D designing in landscape architecture 3. AutoCAD and its scope in landscape designing 4. ArchiCAD its advantages and disadvantages 5. Elements, tools and components of AutoCAD Software 6. Lawn management and methods of lawn establishment 7. Bonsai- art or science 8. Bioasthetic planning its application and importance 9. Urban horticulture and its importance Vertical Garden and its scope in India
Projects based learning	2D and 3D designing in AutoCAD

Course Code: ELCT ENT-311	**Course Name:** Biopesticides and Biofertilizers	**Semester:** V

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. (Ag)**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: For understanding the basic characteristics of bio-fertilizers and bio-pesticides, evaluate the efficiency and potential of their use in the field

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the importance of bio-pesticides in present scenario.
CO-2	Explain the concepts and classification of bio-fertilizers and bio-pesticides
CO-3	Utilize the quality parameters of various agricultural products and bio-fertilizer in maintaining the soil health.
CO-4	Examine the significance and implementation of bio-pesticide and bio-fertilizer in organic farming.
CO-5	Determine the performance of bio-pesticides/ bio-fertilizers through field application.
CO-6	Formulate the various bio-pesticides and bio-fertilizers.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Assignment Power Point Presentation
AT1-3	Quiz
AT1-4	Models
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	**Unit wise contents details**	**Assessment tools**

Course Contents	**Unit – 1** History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses.	Quiz Assignment
	Unit – 1I Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.	Quiz Assignment
	Unit – III Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.	Quiz Assignment
	Unit – IV Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza.	Quiz Assignment
	Unit-V Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers.	Quiz Assignment

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Isolation and purification of important biopesticides: Trichoderma, Pseudomonas, Bacillus, Metarhyzium etc. and its production. 2. Identification of important botanicals. 3. Visit to biopesticide laboratory in nearby area. 4. Field visit to explore naturally infected cadavers. 5. Identification of entomopathogenic entities in field condition. 6. Quality control of biopesticides. 7. Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. 8. Mass multiplication and inoculums production of biofertilizers. 9. Isolation of AM fungi -Wet sieving method and sucrose gradient method. 10. Mass production of AM inoculants.	Activity based learning can be given to implement application aspect
Resources:	Board, Power Point Presentation, Models present in the lab, Demonstration in the laboratory and field.	
Assignment/Tutori	Students are required to submit the given assignments and deliver one power point presentation as a part	

al:	of their continuous evaluation system.
List of Assignments	1. Importance, scope and potential of Biopesticide 2. Importance, scope and potential of bio-fertilizer 3. Virulence, pathogenicity and symptoms of entomopathogenic pathogens. 4. Virulence, pathogenicity and symptoms of entomo-pathogenic nematodes.
Suggested reading:	**A. Textbooks:** 1. Elements of Economic Entomology – B. Vasantraj David and VV Ramamurthy (8th Edition) 2. Handbook of Entomology – TV Prasad 3. Soil Science – DK Das
Suggested e-resources (Websites/e-books)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8230470/ https://www.frontiersin.org/articles/10.3389/fmicb.2023.1040901/full https://chemicals.nic.in/sites/default/files/IPFT_talk_-Venkatesan__NBAIR__Bangalore.pdf https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7181464/ http://naas.org.in/Policy%20Papers/policy%2062.pdf

Course Code: ELCT-AENG-311 **Course Name:** Artificial Intelligence **Semester:** V

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	2	0	0		2		**B.Sc. (Ag)**
Curriculum level					• Information based • Research Based • Skill Based	**Student specific course outcome**	Research Higher education Placement

Practical are conducted as field with separate credits (01) credits

Objective:

•For understanding about the ecosystem.

•To know the bio-diversity existing in environmental surroundings.

Course outcomes: Through this course students will be able to:

CO-1	Remember the LIPS and PROLOG.
CO-2	Describe A and AO logarithm.
CO-3	Apply the knowledge of LIPS and PROLOG in constructing symbolic grammars for natural language that would be used to construct logical representations of sentences.
CO-4	Analyse the uncertainty on the basis of probabilistic interferences.
CO-5	Prepare the robot with artificial intelligence.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	One Midterm Exams

AT1-2	Assignment Power Point Presentation
AT1-3	Quiz
AT1-4	Models
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	Unit – 1 Foundation and history of artificial intelligent, problems and techniques – AI programming languages, introduction to LISP and PROLOG- problem spaces and searches, blind search strategies, Breadth first- Depth first- heuristic search techniques	Assignment Quiz
	Unit – 2 Hill climbing: best first-A* algorithm AO* algorithm- game tree, Min max algorithms, game playing- alpha beta pruning. Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems.	Quiz Mid term
	Unit – 3 Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and Dempster shafer theory, Heuristic methods, symbolic reasoning under uncertainty, Statistical reasoning, Fuzzy reasoning, Temporal reasoning, Non monotonic reasoning.	Assignment Poster
	Unit – 4 Planning and planning in situational calculus, representation for planning, partial order planning algorithm, learning from examples, discovery as learning, learning by analogy, explanation based learning, neural nets, genetic algorithms.	Poster Model
	Unit – 5 Principles of Natural language processing, rule based systems architecture, Expert systems, knowledge acquisition concepts, AI application to robotics, and current trends in intelligent systems.	Quiz

Resources:	Board, Power Point Presentation, Models present in the lab, Demonstration in the laboratory and field.
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Preparation of plant identification database for the assign plant species along with identification name plate with In-built barcode 2. Varietal health of ornamental and MAP crops. 3. Value addition process of assign crop
Suggested reading:	1. Russell, S. and P. Norvig. 1998. Artificial Intelligence: A Modern Approach. Prentice Hall. 2. Rich, Elain and Kevin Knight. 1991. Artificial Intelligence. TMH. Patrick 3. Henry Winston. 1992. Artificial intelligence. Addition Wesley 3 rd Ed. 4. Nilson Nils J. Principles of Artificial Intelligence. Norsa Publishing House.

VI SEMESTER

Course Code: AGRON 323	**Course Name:** Practical Crop Production-II (Rabi Crops)	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	0	0	2		4		**B.Sc. (Ag), AGRON**
Curriculum level					Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To impart technical skills on various crop production technologies through hands on training (Learning-by-doing).

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts and principles of crop production, management and protection
CO-2	Illustrate the conventional practices and novel technological advances in the field of crop production, seed production and crop protection
CO-3	Utilize the conventional and novel technologies in field to achieve high economic return in sustainable manner
CO-4	Analyse the impact of various intercultural operation, technological intervention on yield and quality in different Rabi crops
CO-5	Assess the sustainability of various crop production technologies for commercial crop production and quality seed production with better cost benefit ratio in different Rabi crops

Teaching Pedagogy:

T1	On field Instruction Activity based learning using different tools Collaborative learning Field demonstration of cultivation practices
T2	Assignment Group discussions or debate Learning-by-doing

Assessment tools	
AT1-1	Field performance
AT1-2	Assignment
AT1-3	Report writing

AT1-4	Presentation
AT1-5	Attendance
AT1-6	Viva voce

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.	Field performance, Report writing, Presentation, Attendance Viva voce
Resources:	LCD, Agronomy lab, field for crop cultivation	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	24. Novel technological advances in the field of crop production 25. Advances in Seed Production and Management 26. Conservation Agriculture as a Sustainable System for Soil Health 27. Integrated Nutrient Management in different Rabi Crops 28. Integrated Weed Management in different Rabi Crops 29. Integrated plant disease management (IDM) in different Rabi Crops 30. Integrated Insect Pest Management in different Rabi Crops	
Suggested reading:	**A. Textbooks:** 1. Dr. Rajendra Prasad "Textbook of field crop production" 2019. 2. Chhidda Singh "Raising of field crops" 2018. 1. Dr. S.K. Taunk , Dr. J.L. Choudhary Dr. G.S. Tomar . 2011. Science of Crop Production Vol 1: Kharif Crops Paperback . Kushal Publications and Distributors. 2. Arya R. L., Arya Keshav, Dev Karan, Jatav A. L. 2016. Kharif Crop-Production. Kalyani Pub., Ludhiana.	
Suggested e-resources (Websites/e-books)	22. https://www.mdpi.com/2571-8789/6/4/87 23. https://www.ceew.in/sites/default/files/CEEW_ZBNF_Issue_Brief_2nd_Edition_19Sep18.pdf 24. https://sci-hub.se/https://doi.org/10.1007/978-981-15-4198-8 25. https://www.mdpi.com/2071-1050/14/3/1689 26. https://www.intechopen.com/chapters/64227 27. https://link.springer.com/article/10.1007/s13593-023-00884-x 28. https://link.springer.com/book/10.1007/978-981-19-5888-5	

Course Code: AGRON-321	**Course Name:** Rainfed Agriculture and Watershed Management	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag)**
Curriculum level							Informationbased Critical thinkingbased Research based	**Student specific course outcome**	Placement Research Higher education Higher

Objective: To teach the students about rain fed agriculture and watershed management for better yield with suitable crops varieties.

Course outcomes: Through this course students will be able to:

CO-1	Understand the concepts of watershed management and its effect on land, water and ecosystem resources
CO-2	Analyse public policies and practices of watershed planning
CO-3	Apply the principles and concepts in the field to conserve water resources and improve the crop productivity in Rainfed ecosystems
CO-4	Analyse the impact of watershed planning through case studies
CO-5	Assess control and mitigation techniques for watershed problem

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz

AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Rainfed agriculture: Introduction, types, History of rainfed agriculture & watershed in India. Problems and prospects of rainfed agriculture in India . Soil and climatic conditions prevalent in rainfed areas.	Assignment
	Unit – 2 Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition.	Mid Term examination Report writing
	Unit – 3 Water harvesting: importance, its techniques. Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas.	Field trial Presentation
	Unit – 4 Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.	ABL Quiz

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	27. Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. 28. Studies on cropping pattern of different dry land areas in the country and demarcation of dry land area on map of India. 29. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. 30. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. 31. Studies on cultural practices viz. mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. 32. Characterization and delineation of model watershed.	Practical Practical Record Viva voce Practical

		Model
Resources:	LCD, OHP, Black Board,field	
Assignment/Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	31. Water harvesting Soil moisture conservation	
Suggested reading:	1. Handbook of Agriculture, ICAR, New Delhi 2. Suresh, 2016, Soil and Water Conservation Engineering, New Delhi 3. Principles of Agronomy by SR Reddy 4. Rainfed Agriculture and watershed Management by Rayees Ahmad Shah, 2017.	
Suggested e-resources (Websites/e-books)	1. https://agricoop.nic.in/Documents/121233187_rapfinaldraft%20(1)_repaired.pdf 2. https://epubs.icar.org.in/index.php/IndFarm/article/view/97014/38629 3. https://www.manage.gov.in/publications/eBooks/Soil%20and%20Water%20Conservation%20Techniques%20in%20Rainfed%20Areas.pdf 4. https://www.nabard.org/auth/writereaddata/tender/2007223429Paper-2-%20Rainfed-Agriculture-Dr.-Deshpande.pdf	

Course Code: AENG-321	**Course Name:** PROTECTED CULTIVATION AND SECONDARY AGRICULTURE	**Semester**: VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (perweek)**	**Independent Study Hos (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Hons.) Ag**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective: To modify the natural environment by practices or structures to achieve optimal productivity of crops by enhancing yields, improving quality, extending the effective harvest period and expanding production areas.

Course outcomes: Through this course students will be able to:

CO.1:	List out the importance of Protected cultivation and its scope in India.
CO.2:	Discuss various types of greenhouse structures
CO.3:	Apply the concept of protected cultivation in major crops of India.
CO.4:	Examine the basics of nursery management under protected structures.
CO.5:	Evaluate the utility of different growing media and growing conditions under protected structures.
CO.6:	Create the budget and design for protected cultivation and structures.

Teaching Pedagogy:

T1	Class room teaching (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools			
AT1-1	Mid-term Exams	**AT1-6**	Activity Based Learning
AT1-2	Seminar Presentation and Report	**AT1-7**	Remedial class
AT1-3	Field Visit Report		
AT1-4	Quiz		
AT1-5	Assignments		

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1: Introduction to Protected cultivation and Secondary Agriculture** Importance and scope of protected cultivation Greenhouse effects and types of greenhouses	Class room teaching(Chalk-board) PowerPoint Presentations
	Unit – 2: Planning and design of greenhouses Components of greenhouse Orientations of Greenhouse Design and size of Greenhouse Load distribution Green house equipment's, materials of construction for traditional and low-cost green houses.	ABL activities Assignments Flip Class/ SeminarsQuiz Industrial Visit
	Unit – 3: Irrigation under Protected Structures Types of irrigation Installation of Irrigation Fertigation	Class room teaching(Chalk-board) PowerPoint Presentations
	Unit -4: Cooling and Heating System Active heating and components Active Cooling system and Components Cost estimation and economic analysis of Greenhouse Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.	Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-5: Drying and dehydration: Moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer), Material handling equipment; conveyer and elevators, their principle, working and selection	Assignments Flip Class/ Seminars Quiz Software work

Practical Exercise*	Course Modules	Assessment tools
Practical Exercise*	1. Greenhouse effects and types of greenhouses 2. Greenhouse design and Concept of greenhouse orientation 3. Load distribution under greenhouse design 4. Greenhouse components and structures 5. Visit to various Post Harvest Laboratories. 6. Determination of Moisture content of various grains by oven drying & infraredmoisture methods. 7. Determination of Moisture content of various grains by moisture meter. 8. Field visit to seed processing plant or Storage structure	Activity based learning can be given to implement application aspect
Suggested reading:	1. Vilas M. Salone and Ajay K. Sharma.2012. Greenhouse Technology and Applications. Agrotech Publishers. New Delhi. 2. S. Prasad and U. Kumar. 2012. Greenhouse Management of Horticultural Crops. Second edition, Agrobios. New Delhi	

	3. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida. 4. K.Radha Manohar and C. Igathinathane, 2013. Greenhouse Technology and Management BS Publications.
Resources:	Lab, Garden tools, Planting materials, Design tools, Drawing tools
Assignment/ Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of theircontinuous evaluation system.
Suggested e-resources (Websites/e-books)	https://nhb.gov.in/pdf/Technical_Standard.pdf https://horticulture.tg.nic.in/polyhouse/Downloads/Technical%20Specification.pdf https://midh.gov.in/PDF/cost_norm.pdf https://www.mofpi.gov.in/sites/default/files/NHB-English-for-Web.pdf

Course Code: PP-321	**Course Name:** Diseases of field and Horticultural Crops and their Management-II	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
03	3	2	1				04		**B.Sc. (Ag), Plant Pathology**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education Higher

Objective: To provide the comprehensive knowledge of the skills, and practical experience in disease identification, diagnosis, and management of diseases in field and horticultural crops, and prepare them to make informed decisions and implement sustainable disease management strategies in agricultural production systems.

Course outcomes: Through this course students will be able to:

CO-1	Describe the types of symptoms produced by Fungal, Bacterial, viral and Phytoplasmal pathogens on field and horticultural crops.
CO-2	Identify the different types of pathogens and their etiology associated with field and horticultural crops.
CO-3	Demonstrate the disease cycle and favourable condition for development of diseases
CO-4	Investigate the management practices for major diseases of field and horticultural crops.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam

AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	**Module wise details**	**Assessment tools**
Course Contents	**Unit – 1** Symptoms, etiology, disease cycle and management of following diseases: **Wheat:** Rusts, Loose smut, Karnal bunt, Powdery mildew, Alternaria blight, and Ear cockle; **Sugarcane:** Red rot, Smut, Wilt, Grassy shoot, Ratoon stunting and Pokkah Boeng; **Sunflower:** Sclerotinia stem rot and Alternaria blight;	Presentation
	Unit – 2 Symptoms, etiology, disease cycle and management of following diseases: **Mustard:** Alternaria blight, White rust, Downey mildew and Sclerotinia stem rot; **Gram:** Wilt, Grey mould and Ascochyta blight; **Lentil:** Rust and Wilt; **Cotton:** Anthracnose, Vascular wilt, and Black arm; **Pea:** Downy mildew, Powdery mildew and Rust;	Mid Term examination Report writing
	Unit – 3 Symptoms, etiology, disease cycle and management of following diseases: **Mango:** Anthracnose, Malformation, Bacterial blight and Powdery mildew; **Citrus:** Canker and Gummosis; **Grape vine:** Downy mildew, Powdery mildew and Anthracnose; **Apple:** Scab, Powdery mildew, Fire blight and Crown gall; **Peach:** Leaf curl; **Strawberry:** Leaf spot	Assignment Field trial
	Unit – 4 Symptoms, etiology, disease cycle and management of following diseases: **Potato:** Early and Late blight, Black scurf, Leaf roll, and Mosaic; **Onion and garlic**: Purple blotch, and Stemphylium blight; **Chillies:** Anthracnose and Fruit rot, Wilt and Leaf curl;	ABL Quiz
	Unit – 5 Symptoms, etiology, disease cycle and management of following diseases: **Cucurbits:** downy mildew, powdery mildew, wilt; **Turmeric:** leaf spot **Coriander:** Stem gall **Marigold:** Botrytis blight; **Rose:** Dieback, Powdery mildew and Black leaf spot.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	5. Identification of different equipment's and glassware's used in Plant Pathology Laboratory 6. Visit to field for diagnosis of different diseases of field crops 7. Visit to field for diagnosis of different diseases of horticultural crops. 8. Preparation of different types of media. 9. Isolation of pathogens associated with plant diseases 10. Cultural and morphological identification of plant pathogens 11. Histo-pathological studies of diseases. 12. To study about the management practices of diseases. 13. Collection and preservation of plant diseased specimens for herbarium.	Practical Activity Practical Record Viva voce Spot Identification
Resources:	LCD, OHP, Black Board, Plant Pathology Laboratory.	
Assignment/Tutorial :	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	14. Processes of identification of different plant disease. 15. Identification of fungal disease in plant. 16. Identification of different bacterial disease in plant. Identification of different vector-based disease in plant.	
Suggested reading:	**Textbooks:** 5. Rangaswami, G &Mahadevan, K.2001. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd, New Delhi. 6. Pathak, V.N.2001. Diseases of Fruit crops. Oxford & IBH Publications, New Delhi 7. Singh, R.S.1999. Diseases of Vegetable crops. Oxford & IBH Publications, New Delhi **8.** Chaube, H.S and V.S. Pundhir, 2012. Crop Diseases & Their Management. PHI Pvt .Ltd, New Delhi. **Reference books:** 3. George N. Agrios. 2005. Plant Pathology 5th Edition, Academic Press University of Florida, Gainesville, U.S.A. 4. Singh, R.S.2005. Plant Diseases. Oxford & IBH Publications, New Delhi	
Suggested e-resources (Websites/e-books)	4. https://apsjournals.apsnet.org/toc/pdis/current 5. https://www.iaritoppers.com/2019/06/Disease-Of-Horticultural-Crops-and-Their-Management-ICAR-E-course	

Course Code: HORT 321	Course Name: Post-Harvest Management and Value Addition of Fruits and Vegetables	Semester: VI

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1		3		B.Sc. (Hons.) Ag
Curriculum level					• Information based • Critical thinking based • Research based	Student specific course outcome	• Placement • Higher education • Soft skill development

Objective: To impart comprehensive knowledge on processing of fruits and vegetables.

Course outcomes: After completion of course, the student will be able to:

CO-1	Understand the causes of postharvest loss and changes in fruits and vegetables.
CO-2	Illustrate the maturity and ripening process.
CO-3	Describe different storage techniques for horticultural produce.
CO-4	Discuss principle and methods of processing or value addition.
CO-5	Prepare value added product from fruit and vegetable

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching Power Point Presentations
T2	ABL activities Field demonstration of cultivation practices, Assignment Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Quiz
AT1-4	Activity based learning
AT1-5	Group discussion
AT1-6	Industrial visit
AT1-7	Seminar presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**UNIT-I: Introduction:** importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses.	The assessment tools include: Assignment, Presentation, Quiz, Midterm Exams and end term exam, Activity based learning, Industrial visit
	UNIT-II: Postharvest changes: Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening, respiration and factors affecting respiration rate.	
	UNIT-III: Harvesting and Storage methods: harvesting and field handling, ZECC, cold storage, CA, MA, and hypobaric storage.	
	UNIT-IV: Value addition-I: principles and methods of preservation, intermediate moisture food- jam, jelly, marmalade, preserve, candy – concepts and standards, fermented and non-fermented beverages	
	UNIT-V: Value addition-II: tomato products- concepts and standards; drying or dehydration of fruits and vegetables – concept and methods, osmotic drying; canning -– concepts and standards, packaging of products.	

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. To study packaging and use of containers for shelf life extension. 2. To study effect of temperature on shelf life and quality of produce. 3. To study chilling and freezing injury in vegetables and fruits. 4. To study extraction and preservation of pulps and juices. 5. To study preparation of osmotically dried products, fruit bar and candy. 6. To study preparation of jam and jelly. 7. To prepare RTS, nectar and squash from different kind of fruits. 8. To prepare different tomato products. 9. To study different canned products. 10. To study physico-chemical and sensory quality evaluation of products. 11. Visit a processing unit/ industry.	• Spot Identification • Practical Activity • Practical Record • Regularity • Viva voce
Resources:	LCD, Black/White Board, Laboratory	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Collection of edible portion while processing 2. Preparation of dried products 3. Quiz	
Suggested reading:	**A. Text and Reference books:** • Post-Harvest Management of Horticulture cropsby KP Sudheer and Vi Indira Editor: KV Peter • Postharvest Management and Processing Of Fruits And Vegetables By Satish Sharma, New India Publishing Agency, Delhi • Postharvest Technology of Horticultural Crops (Vol-7) By K. P. Sudheer And V. Indira, New India	

	Publishing Agency. • Post-Harvest Management And Processing Of Fruits And Vegetables (2012) By N.S. Rathore, G. K. Mathur, S. S. Chasta, The Energy And Resources Institute. • Fruit Vegetable Preservation By R. P. Srivastava And Sanjeev Kumar, Cbs Publishing
Suggested e-resources (Websites/e-books)	1. https://ciah.icar.gov.in/publication/Technical_bulletin/2018/dehydration_of_arid_hort.pdf 2. https://www.nabard.org/auth/writereaddata/file/NSP%20on%20Food%20and%20Agro%20Processing.pdf

Course Code: ENT-321	**Course Name:** Management of Beneficial Insects	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Hons), Ag**
Curriculum level							Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective: To impart knowledge about the beneficial Insects and their multiplication & management.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the importance of beneficial insects including pollinators, parasitoids and predators.
CO-2	Explain the rearing techniques and management practices of beneficial insects according to their behavioural and ecological aspects
CO-3	Demonstrate the mass multiplication techniques of commercial insects and biological control agents.
CO-4	Analyse the effect of cultivation methods of commercial insect on their produce and also mass rearing techniques of bio-control agents
CO-5	Evaluate the effect of natural enemies on the pest management.

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate

AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**UNIT-I:** Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management.	Assignment, Quiz , Mid-term examinations
	UNIT-II: Bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.	Assignment, Unannounced test Mid and End Term Examinations
	UNIT-III: Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.	Skill test , Quiz. end term examinations
	UNIT-IV: Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.	Group discussions or debate, Assignment, Extempore, End Term Examinations
	UNIT-V: Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Honey bee species, castes of bees. 2. Beekeeping appliances and seasonal management, bee enemies and disease. 3. Bee pasturage, bee foraging and communication. 4. Types of silkworm, voltinism and biology of silkworm. 5. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. 6. Species of lac insect, host plant identification. 7. Identification of other important pollinators, weed killers and scavengers. 8. Visit to research and training institutions devoted to beekeeping. 9. Visit to research and training institutions devoted to lac culture. 10. Visit to research and training institutions devoted to natural enemies. 11. Identification and techniques for mass multiplication of natural enemies.	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, Entomology lab	

Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	
Suggested reading:	**A. Text and Reference books:** 1. Thomas K Sabu. 2012. Selected Beneficial and Harmful Insects of Indian Subcontinent. LAP Lambert Academic Publishing. 2. The Xerces Society. 2014. Farming with Native Beneficial Insects: Ecological Pest Control Solutions Kindle Edition. Storey Publishing, LLC. Abrol DP. 2010. Bees and Beekeeping in India. Kalyani Publishers, New Delhi, India. Atwal AS. 2000. Essentials of Beekeeping and Pollination. Kalyani Publishers, New DelhiLudhiana, India. 3. Ministry of Agriculture and Fisheries. 2018. Beneficial Insects (Classic Reprint). Forgotten Books.
Suggested e-resources (Websites/e-books)	1. https://www.researchgate.net/publication/314379406_BENEFICIAL_INSECT_FARMING_Benefits_and_Livelihood_Generation 2. http://naas.org.in/Policy%20Papers/policy%20110.pdf 3. https://csb.gov.in/wp-content/uploads/2019/08/Mulberry-Pests-Management-Practices.pdf

Course Code: GPB-321 **Course Name: Crop Improvement II (Rabi Crops)** **Semester: VI**

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Ag), GPB**
Curriculum level							Information based Critical thinking basedResearch based	**Student specific course outcome**	Placement Research Higher education

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activitiesAssignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Seminar Presentation
AT1-3	Quiz
AT1-4	Poster
AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Report writing
AT1-8	Field trial
AT1-9	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	Unit – 1 Cereals (Wheat, oat and barley) and Pulses (Chickpea)- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and moderninnovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality.	PresentationField trial

	Unit – 2 Oilseeds (Linseed, Rapeseed, Sunflower and Mustard) and Vegetable (Potato)- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional). . Hybrid seed production technology.	Mid Term examination Report writing
	Unit – 3 Fodders (Lucern and Berseem) and Cash crop (Sugarcane)- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)	AssignmentField trial
	Unit – 4 Vegetable-(Tomato, Brinjal, Chilli, Onion)- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical,nutritional)	ABL Quiz
	Unit-V Horticultural crops (Mango, Aonla and Guava)- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional). Plant genetic resources, its utilization and conservation. Adaptability and stability. Ideotype concept and climate resilient crop varieties for futureWheat, Rice, Maize, Sorghum and Cotton.	End term examination ABL Spotting Viva Voce

Practical Exercise* (Min-8)	Course Modules	Assessmenttools
	Floral biology, emasculation and pollination techniques in wheat. Floral biology, emasculation and pollination techniques in chickpea. Floral biology, emasculation and pollination techniques in mustard. Floral biology, emasculation and pollination techniques in sunflower. Floral biology, emasculation and pollination techniques in potato. Floral biology, emasculation and pollination techniques in sugarcane. Study of field techniques for hybrid seed production. Estimation of heterosis, inbreeding depression and heritability. Layout of field experiment. Study of quality characters, study of donor parents for different characters	Practical Activity Practical Record Viva voceSpot Identification
Resources:	LCD, OHP, Black Board, Molecular Biology Laboratory.	
Assignment/ Tutorial:	Students are required to submit one assignment and deliver one power pointpresentation as a part of their continuous evaluation system.	
List of Assignments	Status of rabi crops area and production in different states of India Varietal health of rabi crops	

Suggested reading:	Textbooks: B.D. Singh, 2018. Plant Breeding Principles and Methods. KalyaniPublishers. New Delhi. Hari har Ram, 2019. Crop Breeding and Biotechnology. KalyaniPublishers. New Delhi. B. Reference books: Yadav R.K. 2022. Practical Manual on Crop Improvement-II (Rabicrops)). Bhavya Books. Anand Kumar, S.P. Singh, R.B.P. Nirala, P.K. Singh. 2018. BAU,Sabour ISBN: 978-93-5311-156-4.
Suggested e-resources	

Course Code: AGRON-322	**Course Name:** Principles of Organic Farming	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	1	0	1				3		**B.Sc. (Ag), AGRON**
Curriculum level							• Information based • Critical thinking based • Research Based	**Student specific course outcome**	Research Higher education Placement

Objective: To describe imparting training about biological intensive nutrient management vermi-composting, green manuring etc.

Course outcomes: Through this course students will be able to:

CO-1	Describe the principles and scopes of organic farming.
CO-2	Explain the concept of organic ecosystem; and organic nutrient resources and its fortification
CO-3	Demonstrate the restrictions to nutrient use in organic farming.
CO-4	Analyse the certification process and standards of organic farming.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	One Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Unit – 1 Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.	Quiz Mid term
	Unit – 2 Organic ecosystem and their concepts; Organic nutrient resources and its fortification.	Assignments and Quiz Mid term
	Unit – 3 Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP	Assignment Poster
	Unit – 4 Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.	Assignments, Seminars Quiz

Practical/Exercise*	List of practicals (field/lab exercises)	Assessment tools
	1. Visit of organic farms to study the various components and their utilization. 2. Preparation of enrich compost, vermi-compost, bio-fertilizers/bio-inoculants and their quality analysis. 3. Indigenous technical knowledge (ITK) for nutrient, insect, pest disease and weed management. 4. Cost of organic production system. 5. Post harvest management. Quality aspect, grading, packaging and handling.	Activity based learning is given to implement application aspect
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. History of organic farming. 2. Scope of organic farming in India. 3. Procedure of vermicompost.	

	4. Procedure of biofertilizers. 5. Organic ecosystem and their concepts. 6. Restrictions to nutrient use in organic farming. 7. Certification process and standards of organic farming.
Suggested e-resources (Websites/e-books)	https://apeda.gov.in/apedawebsite/Announcements/NPOP_Training_Manual_English_E_Book.pdf https://www.ifoam.bio/why-organic/shaping-agriculture/four-principles-organic

Course Code: AE-321	**Course Name:** Farm management, production and resource economics	**Semester:** VI

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	1	0	1				3		**B.Sc. (Hon's), Agriculture**
Curriculum level							Information based Critical thinking based Research based	**Student specific course outcome**	Placement Research Higher education

Objective:

- To impart knowledge of different input-output relationships.
- To provide practical knowledge of analysis tools used in farm business management.

Course outcomes: Through this course students will be able to:

CO-1	Describes law of return in farm management
CO-2	Understand factor-product, factor-factor and product- product relationship in static production economics.
CO-3	Utilization of farm resources and selection of crops and livestock's enterprises
CO-4	Examine the farm planning and farm budgeting techniques
CO-5	Evaluate the balance sheet and profit and loss statement

Teaching Pedagogy:

T1	Activity based learning through Power Point Presentations
T2	ABL activities Assignments Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Assignment

AT1-5	Viva voce examination

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – 1** Concept of agricultural production economics, Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, Meaning and concept of cost, types of costs and their interrelationship, law or return	Classroom teaching ABL
	Unit – 2 concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product- product relationship	Assignment Mid Term examination
	Unit – 3 Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises	Quiz Assignment
	Unit – 4 Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.	ABL Assignment Quiz
	Unit-V Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources *etc.*	End term examination ABL Viva Voce

Practical Exercise* (Min-8)	Course Modules	**Assessment tools**
	1. Basic concepts of production economics 2. Calculation different methods of depreciation. 3. Determination of least cost combination of inputs 4. Determination of profit maximization of outputs 5. To study about the balance sheet 6. Computation of cost concepts: CACP approach 7. Preparation of farm plan and budget	Practical Activity Practical Record Viva voce

	8. Farm records and accounts	
Resources:	LCD, White Board	
Assignment/ Tutorial:	Students are required to submit one assignment and quiz as a part of their continuous evaluation system.	
List of Assignments	1. Product-Product relationship 2. Factor-Factor relationship	
Suggested reading:	**Textbooks:** 1. Fundamentals of farm business management – S.S. joshi and T. Kapur, New Age Publisher (2005) 2. Production Economics, J. P. Doll and F. Orazen, CBS publication, New Delhi (2005) **Reference Book:** S.Subba reddy, P.Raghu Ram, T.V.Neelakanta sastry and Bhavani Devi. 2019.Agricultural economics.Oxford; 2nd edition.	
Suggested e-resources (Websites/ e-books)	-	

Course Code: BIOCHEM-BT- 321	**Course Name:** Principles of Food Science and Nutrition	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
2	2	0	0				2		**B.Sc. (Ag)**
Curriculum level							Basic, applied and Innovative	**Student specific course outcome**	Higher Education Placement Research Entrepreneurship

Objective: To equip the students/scholars will gain insights specific nutrients in maintaining health and identifying nutrient specific foods

Course outcomes: After completion of course, the student will be able to:

CO-1	State the importance of physical properties of components of food
CO-2	Identify the nutritional composition of food
CO-3	Use the principles of preservation and methods of preservations
CO-4	Examine the nutritional deficiency in the community
CO-5	Judge and formulation of balanced diet

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching Power Point Presentations
T2	ABL activities Assignment Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Quiz
AT1-4	Activity based learning
AT1-5	Group discussion
AT1-6	Industrial visit
AT1-7	Seminar presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Concepts of food science - Definitions of food, specific nutrients in foods and their functions - Physical characteristics of foods – Importance Food physical characteristics - Density - Phase change, pH, osmosis, surface tension, colloidal systems.	Evaluation will be done to understand the students' ability to utilize the skill set learnt. The assessment tools include: Assignment, Presentation, Quiz, Midterm Exams and end term exam, Activity based learning
	Unit-II: Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).	
	Unit-III: Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).	
	Unit-IV: Food and nutrition, Malnutrition (over and under nutrition), nutritional Disorders, Energy metabolism (carbohydrate, fat, proteins).	
	Unit-V: Balanced/ modified diets, Menu planning, New trends in food science and nutrition.	

Resources:	LCD, White Board
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Essential nutrients and their functions and deficiency symptoms in human 2. Overview of Food Constituents and their Role in Food Chemistry & Nutrition
Suggested reading:	**A. Textbooks:** 17. Srilakshmi B, Food Science. 18. Srilakshmi, B (2002). Nutrition science, new age Int. Ltd. Pub., New Delhi 19. Mudambi, S. R. and Rajagopal. M.V. (2001). Fundamentals of foods and nutrition. New Delhi, New Age International (P) Ltd. New Delh Potter NN and Hotchkiss JH, Food Science. 20. Srilakshmi, B. (2005). Dietetics. New Delhi 5th edn. New Age International (P) Limited. New Delh 21. Gopalan, C., Ramsastri, B.V. and Balasubramanian, S.C. (1990). Nutritive value of Indian foods. 22. Bamji, S.M., Rao, N.P. and Reddy, V. (1996). Textbook of human nutrition. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi. 23. Swaminathan, M. (1985). Essential of food and nutrition. 2nd edition, Vol. II. The Bangalore printing and publishing company Ltd. Bangalore.
Suggested e-resources (Websites/e-books)	1. https://www.tandfonline.com/doi/full/10.1080/19476337.2021.1893824?src=recsys 2. https://www.manage.gov.in/studymaterial/FNS-E.pdf 3. https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf 4. https://www.fssai.gov.in/upload/uploadfiles/files/Guidance_Notes_Version_2_Millets_29_01_2020.pdf

Course Code: ELCT FST- 321	**Course Name:** Food Safety and Standards	**Semester: VI**

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1		4		**B.Sc. (Hons) Ag.**
Curriculum level					• Information based • Critical thinking based • Research based	**Student specific course outcome**	• Placement • Employment ability • Higher education

Objective: To equip the students/scholars for food safety measures and different national and international regulatory bodies along with quality control

Course outcomes: After completion of course, the student will be able to:

CO-1	Define **food safety, hazards and risks factors**
CO-2	Understand importance of h**ygiene, sanitation in food service establishments and national-international food laws and standards**
CO-3	Utilize food safety management tools **and their need for food quality maintenance**
CO-4	Examine **water quality, sanitation, hygiene and waste disposal of food processing unit**
CO-5	Judge **packaging, product, nutritional labelling and recent outbreaks**

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching Power Point Presentations
T2	ABL activities Field demonstration of cultivation practices, Assignment Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	**Mid-term Exams and end term exam**
AT1-2	Assignment
AT1-3	Quiz
AT1-4	Activity based learning
AT1-5	Group discussion
AT1-6	Industrial visit
AT1-7	Seminar presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Unit I: Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage and Product design.	Evaluation will be done to understand the students' ability to utilize the skill set learnt. The assessment tools include: Assignment, Presentation, Quiz, Midterm Exams and end term exam, Activity based learning, Industrial visit
	Unit II: Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control.	
	Unit III: Surface Sanitation and Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc.	
	Unit IV: HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food.	
	Unit V: Recent concerns- New and Emerging Pathogens. Packaging, Product labelling and Nutritional labelling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.	

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Water quality analysis 2. Physico-chemical and 3. Microbiological Examination of different food samples. 4. Preparation of different types of media. 5. Assessment of surface sanitation by swab/rinse method. 6. Assessment of personal hygiene. 7. Biochemical tests for identification of bacteria. 8. Scheme for the detection of food borne pathogens. 9. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000	• Spot Identification • Practical Activity • Practical Record • Regularity • Viva voce
Resources:	LCD, Black/White Board, Laboratory	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Collection of information mentioned on labels of the 05 beverage 2. Quiz	
Suggested reading:	**A. Text and Reference books:** • Ranganna S. Hand book of Analysis and Quality Control for Fruit and Vegetable Products. • Srilakshmi B, Food Science. • Sharma Avanthi. A text book of Food Science and Technology. • Mudambi Sumati R, Rao Shalini M and Rajagopal M.V. Food Science. • Potter NN and Hotchkiss JH, Food Science.	

	• Dev Raj, Rakesh Sharma and Joshi V.K, Quality for Value Addition in Food Processing. • The Food Safety and Standards Act along with Rules & Regulations. Commercial Law Publishers (India) Pvt. Ltd.
Suggested e-resources (Websites/e-books)	https://www.pdfdrive.com/food-plant-sanitation-food-science-and-technology-e161892515.html

Course Code: ELCT-GPB-321	Course Name: Molecular Biology	Semester: VI

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		B.Sc. (Ag), GPB
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To educate the students to understand the molecular mechanisms by which plants grow, differentiate, evolve, and interact with the biotic and abiotic environments.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic understanding on plant genetics and hereditary
CO-2	Understanding of structures, functions, and internal controls within individual cells
CO-3	Recognize and interpret the structural and functional aspects of plant molecules and their interactions
CO-4	Analyse various techniques and the effectiveness of molecular breeding at commercial level.
CO-5	Assess for the new opportunities to speed up plant breeding
CO-6	Develop high yielding verities and enhancing crop resilience to combined abiotic and biotic stress

Teaching Pedagogy:

T1	Class room Lectures/ Guest lectures Laboratory/ Field and lab Practicals Student Seminars/ Presentations
T2	ABL activities Lab and field Tours/ Demonstrations Assignments

Assessment tools	
AT1-1	One Midterm Exam
AT1-2	Seminar, Presentation and Report
AT1-3	Assignment
AT1-4	Activity Based Learning
AT1-5	Preparation of lab test reports

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** History of molecular biology; Central dogma of life; Structure of DNA and RNA; DNA replication; transcription;	Assignment Mid term
	Unit-II: Gene structure and function Genetic code and translation, Structure of prokaryotic and eukaryotic nuclear and organelle genomes; Gene regulation in prokaryotes: Lac operon	ABL activities

	concept, tryp concept.	Mid term
	Unit-III: Introduction to microbial genetics; conjugation, transformation and transduction. Tools in molecular biology: Role of enzymes in molecular biology;	Research field/lab based assignments
	Unit-IV: Principles of Polymerase Chain Reaction; Electrophoresis; PCR and hybridization based molecular markers. Genome editing (Antisense RNA, RNAi, ZFN, TALENs, CRISPR system),	ABL activities
	Unit-V: Recombinant DNA technology, transgenes, method of transformation, GMO; International regulations, biosafety issues of GMOs; Regulatory procedures in major countries including India, ethical, legal and social issues.	Assignment End term

Practical Exercise* (Min-8)	**List of practicals (field/lab exercises)**	**Assessment tools**
	1. Preparation of bacterial competent cells and transformation. 2. Isolation and purification of plant and animal DNA. 3. Measurement of nucleic acid concentration using spectrophotometer and gel electrophoresis. 4. DNA amplification using RAPD, microsatellite primers and analysis. 5. CAPS primers. 6. Generation of linkage maps and mapping of qualitative genes. 7. Estimation of genetic similarities and generation of dendrograms 8. Design of Gene Constructs	Activity based learning can be given to implement application aspect
Resources:	LCD, Black/White Board, Laboratory, Research field	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Molecular Markers in used in crop Improvement 2. Regulatory Framework for GE Plants in India 3. Molecular mechanisms of host-pathogen interaction	
Suggested reading:	**A. Textbooks:** 1. Allison LA. 2011. Fundamental Molecular Biology. Wiley Global Education. 2. Carson S, Miller HB & Witherow DS. 2012. Molecular Biology Techniques A Classroom Laboratory manual. Elsevier. 3. Kreuzer H & Massey A. 2008. Molecular Biology and Biotechnology: A Guide for Teachers. ASM Press. 4. Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A & Scott MP. 2012. Molecular Cell Biology. W. H. Freeman. 5. Sambrook J, Russel D. 2001. Molecular Cloning: A Laboratory Manual. 3rd Ed Cold Spring Harbor Laboratory Press. 6. Surzycki S. 2000. Basic Techniques in Molecular Biology. Springer Berlin Heidelberg 7. Voet D, Voet JG & Pratt CM. 2004. Fundamentals of Biochemistry. 2nd Ed. New York: Wiley. 8. Walker JM & Rapley R. 2000. Molecular Biology and Biotechnology. 4th Ed. The Royal Society of Chemistry. 9. Watson JD, Bakee TA, Bell SP, Gann A, Levine M & Losick R. 2008. Molecular Biology of the Gene. 6th	

	Ed. Pearson Education International.
Suggested e-resources (Websites/e-books)	1. https://www.biotech.co.in/sites/default/files/2020-01/2019%20Handbook%20for%20Food%20Safety%20Officials%20%E2%80%93%20Genetically%20Modified%20Foods%20Safety%20Assessment%20and%20Regulations.pdf 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6343535/ 3. https://www.biotech.co.in/sites/default/files/2020-01/Regulatory-Framework-For-GM-Crops-English.pdf 4. http://www.geacindia.gov.in/resource-documents/13_2-Regulatory_Framework_for_GE_Plants_in_India.pdf

Course Code: ELCT-HORT-321	**Course Name:** Protected Cultivation 3 (2+1)	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. (Ag), HORT**
Curriculum level							• Information based • Critical thinking based • Research Based	**Student specific course outcome**	Research Higher education Placement

Objectives:

- For understanding of basic protected cultivation and nursery management.
- To determine the cladding materials and its importance.
- To learn about designing the protected structures.

Course outcomes: Through this course students will be able to:

CO-1	To list out and remember the importance of Protected cultivation and its scope in India.
CO-2	To classify the concept of classifications of protected structures.
CO-3	To apply the concept of protected cultivation for major crops.
CO-4	To examine the Basics of nursery management under protected structures.
CO-5	To evaluate the utility of growing media and growing condition under protected structures.
CO-6	To create the budget and design for protected cultivation and structures.

Teaching Pedagogy:

T1	Class room teaching (Chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Mid-term Exams
AT1-2	Seminar Presentation and Report
AT1-3	Field Visit Report
AT1-4	Quiz
AT1-5	Assignments
AT1-6	Activity Based Learning
AT1-7	Flip Class

Prerequisites	**Unit wise contents details**	**Assessment tools**
Course Contents	**Unit-I: Introduction to Protected cultivation** Protected cultivation- importance and scope, Status of protected cultivation in India and World	Class room teaching (Chalk-board) Power Point Presentations
	Unit-II: Construction and types of protected structures Cladding materials involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation, Soil preparation and management, Substrate management. Types of benches and containers. Types of protected structure based on site and climate	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: Irrigation and propagation under protected structures Irrigation and fertigation management, Propagation and production of quality planting material of horticultural crops	Class room teaching (Chalk-board) Power Point Presentations
	Unit-IV: Greenhouse cultivation of important horticultural crops Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.	Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-V: Cultivation of economically important crops Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management under protected structures.	Assignments Flip Class/ Seminars Quiz

Practical Exercise* **(Min-8)**	**List of practicals (field/lab exercises)**	**Assessment tools**

	1. Practical-1: Preparation and nursery management under Protected structures 2. Practical-2: Propagation and nursery management under Protected structures 3. Practical-3: Bed preparation and planting of crops for productions 4. Practical-4: Intercultural operations 5. Practical-5: Soil EC and pH measurement 6. Practical-6: Regulation of irrigation and fertilizers through drip, fogging ad misting 7. Practical-7: Propagation and management of Ornamental and medicinal/Aromatic crops. 8. Practical-8: Visit to Protected structure	Activity based learning can be given to implement application aspect, Lab work and computer-based work
Resources:	Lab tools	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. Cultivation practices of exotic crops under protected cultivation 2. Cultivation practices of medicinal and aromatic plants under protected cultivation	
Projects based learning	1. Design the protected structures. 2. Types of green houses and cladding materials. 3. Operations under protected cultivation	
Suggested reading:	Prescribed Books: 1. Vilas M. Salone and Ajay K. Sharma.2012. Greenhouse Technology and Applications. Agrotech Publishers. New Delhi. 2. S. Prasad and U. Kumar. 2012. Greenhouse Management of Horticultural Crops. Second edition, Agrobios. New Delhi 3. Reference Books: 4. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida. K.Radha Manohar and C. Igathinathane, 2013. Greenhouse Technology and Management BS Publications.	
Suggested e-resources (Websites/e-books)		

Course Code: ELCT-AEXT-321	**Course Name:** System Simulation and Agro-advisory	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. (Hons.) Ag**
Curriculum level							Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective:

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts of various System simulation tools and techniques used in agriculture fields
CO-2	Compare the various simulation systems with their pros and cons
CO-3	Demonstrate the use of various software for crop modelling, weather forecasting, dissemination of agro-advisory.
CO-4	Analyse the results obtained from different simulation systems with scientific interpretation
CO-5	Assess the suitability of different systems in optimum crop modelling diseases forecasting and weather forecasting

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate

AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, and relational diagrams.	Class room teaching (Chalk-board) Power Point Presentations
	Unit-II: Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation.	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	Class room teaching (Chalk-board) Power Point Presentations
	Unit-IV: Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity	Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-V: Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.	Assignments Flip Class/ Seminars Quiz

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Preparation of crop weather calendars. 2. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. 3. Working with statistical and simulation models for crop growth.	Spot Identification Practical Activity Practical Record Attendance Viva voce

	4. Potential & achievable production; yield forecasting, insect & disease forecasting models. 5. Simulation with limitations of water and nutrient management options. 6. Sensitivity analysis of varying weather and crop management practices. 7. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. 8. Feedback from farmers about the agroadvisory.	
Resources:	LCD, OHP, Black Board, Computer lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	1. ITK for weather forecast in India 2. Crop models, concepts & techniques	
Suggested reading:	**A. Text and Reference books:** Averill M.L. and Kelton D. 2005. Simulation, Modelling and Analysis. Tata McGraw Hill. Gordan G. 2007. System Simulation. Pearson Edu Applied Agroclimatology by O.P.Bishnoi, Oxford Book Company, Jaipur, India302108, Edition 2010. Remote Sensing Techniques in Agriculture by D.D.Sahoo, R.M.Solanki, Agrobios (India), Jodhpur, 2008.	
Suggested e-resources (Websites/e-books)	1. https://sari.umd.edu/sites/default/files/Baxla.pdf.pdf 2. http://apps.iasri.res.in/ebook/TEFCPI_sampling/WEATHER%20FORECASTING%20AND%20AGROMET%20ADVISORY%20SERVICES%20IN%20INDIA.pdf 3. https://krishi.icar.gov.in/jspui/bitstream/123456789/31188/1/CWM%20Lecture%20notes.pdf 4. https://www.drcsc.org/CCA/3/Docs/Technical%20paper%20on%20Weather%20and%20Agro%20Advisary%20Services.pdf	

Course Code: ELCT-ENT-321	**Course Name:** Agrochemicals	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
03	3	2	1				03		**ELCT** ENT-321
Curriculum level							Information based Practical based Research based	**Student specific course outcome**	Placement Research Higher education Higher

Objective:

- To understand the basic chemical nature of fertilizers and pesticides.
- To know the application of pesticides and fertilizer as per the recommendations.

Course outcomes: Through this course students will be able to:

CO-1	acquaint with the advantages and disadvantages of pesticides, plant growth regulators and fertilizers in present scenario.
CO-2	classify pesticides and fertilizers on the basis of various parameters.
CO-3	apply pesticides for the protection of plants and fertilizers to maintain soil health.
CO-4	analyze the residual effect of pesticides and fertilizers.
CO-5	evaluate the efficacy of pesticides formulation and fertilizers through field application.

Teaching Pedagogy:

T1	Activity based learning through lab experimentation Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars One word/ single phrase answer tests

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Presentation
AT1-3	One word/ single phrase answer tests
AT1-4	Group discussion

AT1-5	Activity Based Learning
AT1-6	Viva voce examination
AT1-7	Laboratory experiments performance
AT1-8	Field Application
AT1-9	Spot Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	**Unit – I** An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.	Presentation Group discussion
	Unit – II Herbicides-Major classes, properties and important herbicides - Fate of herbicides. Fungicides - Classification – Inorganic fungicides - Characteristics, preparation and use of sulphur and copper - Mode of action-Bordeaux mixture and copperoxychloride. Organic fungicides-Mode of action-Dithiocarbamates-Characteristics, preparation and use of Zineb and Maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.	Mid Term examination ABL
	Unit – III Introduction and classification of insecticides: inorganic and organic insecticides - Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids, Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Bio-pesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.	One word/phrase questions Assignment ABL
	Unit – IV Fertilizers and their importance. Nitrogenous fertilizers- Feed stocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers-feedstock and manufacturing of single. Super-phosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.	ABL One word/phrase questions
	Unit-V Mixed and complex fertilizers-Sources and compatibility–preparation of major, secondary and micro nutrient mixtures. Complex fertilizers- Manufacturing of ammonium phosphates, nitro-phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.	End term examination Viva Voce

Practical Exercise*	Course Modules	Assessment tools

	24. Sampling of fertilizers and pesticides. 25. Pesticides application technology to study about various pesticides appliances. 26. Quick tests for identification of common fertilizers. 27. Identification of anion and cation in fertilizer. 28. Calculation of doses of insecticides to be used. 29. To study and identify various formulations of insecticide available in market. 30. Estimation of nitrogen in Urea. 31. Estimation of water soluble P2 O5 and citrate soluble P2 O5 in single super phosphate. 32. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. 33. Determination of copper content in copper oxychloride. 34. Determination of sulphur content in sulphur fungicide. 35. Determination of thiram and ziram content.	1. Laboratory based experiments performance 2. Field Application 3. Spot Identification 4. Maintenance of practical record
Resources:	White Board, Models present in the lab, Demonstration in the laboratory and field, Entomology, Soil Science and Analytical Laboratory	
Assignment/Tutorial:	Students are required to take part in given assignments and attend one word/ single phrase tests a part of their continuous evaluation system.	
List of Assignments	**Topic for Presentation (selected by individual students for presentation):** 1. Mechanism of Herbicidal Selectivity – Priyanshu Pandey 2. Harmful effects of Pesticides – Vishal Yadav 3. Bio-herbicides - Ipshweta 4. Nano-pesticides - Gourob Mondal 5. Bio-magnification – Ratandeep 6. 2,4-D – Vikash Kumar 7. 2,4,5-T – K Jayavardhan 8. Mercury Fungicides – K. Anand 9. Herbicide and its Classification – Hemant Pandey 10.Organic and Inorganic Insecticides – Khushi Singh Rajput **Topic for GD (Group Discussion):**	

	Merits and Demerits of Agrochemicals
Suggested reading:	**Text Books:** 1. Vasantharaj David, B and Ramamurthy V V. 2016. *Elements of Economic Entomology.* Np Namuratha Publications, Chennai. 2. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. *General and Applied Entomology.* Tata McGraw-Hill Publishing House, New Delhi. 3. Srivastava R P and Saxena R C 1989. *A text book of Insect toxicology.* Himanshu Publications, Udaipur 4. S Sriramulu1979. *Methods of Pesticide analysis.* Oxford IBH, New Delhi **Reference Books:** 1. "Agrochemicals: Composition, Production, Toxicology, Applications" by Franz Müller 2. "Agrochemicals: Preparation and Mode of Action" by R J Cremlyn "Fate of Agrochemicals in Terrestrial Ecosystems: An Integrated Modelling Framework" by Joint Research Centre and European Commission
Suggested e-resources (Websites/e-books)	UGA Extension Special Bulletin 28 Georgia Pest Management Handbook—2020 Commercial Edition (https://extension.uga.edu/content/dam/extension/programs-and-services/integrated-pest-management/documents/handbooks/2020-pmh-chapters/PesticideRate-Dosage.pdf)

Course Code: ELCT-AENG-321	**Course:** Name: Information Technology for Land and Water Management	**Semester:** VI

Credits	**L**	**T**	**P**	**Marks**			**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
3	2	0	1				4		**B.Sc. (Hons.) Ag**
Curriculum level							Basic and applied	**Student specific course outcome**	Higher Education Placement Research

Objective:

Course outcomes: After completion of course, the student will be able to:

CO-1	Define the basics of Information Technology and its applications in land and water management
CO-2	Understand the use of various computer applications in data presentation, analysis and interpretation
CO-3	Demonstration the use of different IT tools application in agricultural resources management
CO-4	Analyse the role database management systems in agricultural resources management
CO-5	Evaluate the various computer based models/approaches used for solving agriculture-based problems.
CO-6	Develop the contingent plan for land and water management in different climatic conditions using various IT tools

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate

AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit-I:** Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Existing system of information generation and organizations involved in the field of land and water management.	Assignment, Quiz , Mid-term examinations
	Unit-II: Application and production of multimedia. Internet application tools and web technology. Networking system of information. Problems and prospects of new information and communication technology.	Assignment, Unannounced test Mid and End Term Examinations
	Unit-III: Development of database concept for effective natural resources management. Application of remote sensing, geographic information system (GIS) and GPS. Rational data base management system.	Skill test , Quiz. end term examinations
	Unit-IV: Object oriented approaches. Information system, decision support systems and expert systems. Agricultural information management systems - use of mathematical models and programmes.	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V: Application of decision support systems, multi sensor data loggers and overview of software packages in natural resource management. Video-conferencing of scientific information.	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	Multimedia production. Internet applications: E-mail, voice mail, web tools and technologies. Handling and maintenance of new information technologies and exploiting their potentials. Exercises on database management using database and spreadsheet programmes. Usage of remote sensing, GIS and GPS survey in information generation and processing. Exercises on running computer software packages dealing with water balance, crop production, land	

	development, land and water allocation, watershed analysis etc. Exercises on simple decision support and expert systems for management of natural resources. Multimedia production using different softwares. Exercises on development of information system on selected theme(s). Video-conferencing of scientific information.	
Resources:		
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments		
Suggested reading:	**A. Text and Reference books:** 1. Climate-Smart Agriculture – Source Book. 2013. Food and Agriculture Organization, Rome. 2. Daniel P. Loucks and Eelco van Beek. 2005. Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications. UNESCO, Paris. 3. Dipak De and Basavaprabhu Jirli (Eds.). 2010. Communication Support for Sustainable Development. Ganga Kaveri Publishing House, Varanasi – 221001. 4. FAO. 1998. Land and Water Resources Information Systems. FAO Land and Water Bulletin 7, Rome. 5. Fuling Bian and Yichun Xie (Eds.). 2015. Geo-Informatics in Resource Management and Sustainable Ecosystem. Springer, New York. 6. ICFAI Business School (IBS). 2012. Information Technology and Systems. IBS Centre for Management Research, Hyderabad. 7. Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Environmental Science. Springer, New York. 8. Sarvanan. R. 2011. Information and Communication Technology for Agriculture and Rural Development. New India Publishing Agency, New Delhi. 9. Soam, S.K., P.D. Sreekanth and N.H. Rao (Eds.). 2013. Geospatial Technologies for Natural Resources Management. New India Publishing Agency, Delhi.	
Suggested e-resources (Websites/e-books)		

VII SEMESTER

Course Code: RAWE	**Course Name:** Rural Agricultural Work Experiences	**Semester:** VII

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
20	0	0	20		20		**B.Sc. (Hons.) Ag, RAWE**
Curriculum level					Applied	**Student specific course outcome**	Higher Education Placement Research

Objective: Student READY (Rural Entrepreneurship Awareness Development Yojana) programme is a new initiative of Indian Council of Agricultural Research to reorient graduates of Agriculture and allied subjects for ensuring and assuring employability and develop entrepreneurs for emerging knowledge intensive agriculture.

Course outcomes: After completion of course, the student will be able to:

CO-1	Real Field Experiences of farmers Field
CO-2	Industry Visit
CO-3	Visit to Successful farmers Field
CO-4	Unit Attachment
CO-5	N/A

Teaching Pedagogy:

T1	Power Point Presentations
T2	Project report of each Components

Assessment tools	
AT1-1	Weekly report Assessment
AT1-2	Final report Assessment
AT1-3	Components Wise report Assessments
AT1-4	Certificate of Each Components
AT1-5	Final Viva and power Point Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	**Unit – 1** Village Attachment	Weekly Report Evaluation
	Unit – 2 Unit Attachments	Weekly Report Evaluation
	Unit – 3 Industry Attachments	Weekly Report Evaluation

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	29. Village Attachments (Annexure 1 to 8) 30. Agro-Industry Attachments 31. Unit Attachments	Power Point Presentation and Viva Voice Exam
Resources:	Real Field Exposure and Field Visit	
Assignment/ Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	Weekly Reports submission and final report submission on LMS Report preparation Presentation	
References:	ICAR 5th dean Committee	
Suggested e-resources (Websites/e-books)	1. https://icar.org.in/files/Guidelines%20_RAWE-16112015.pdf 2. https://education.icar.gov.in/student_ready#:~:text=The%20Rural%20Agricultural%20Work%20Experience,transferring%20the%20latest%20agricultural%20technologies.	

VIII SEMESTER

Course Code: ELP-HORT-404	**Course Name:** Commercial Nursery Establishment and Mass Multiplication of Horticultural Crops	**Semester: VIII**

Credits	**L**	**T**	**P**	**Marks**	**Contact Hours (per week)**	**Independent Study Hour (per week)**	**Section (Group)**
10	0	0	10		20		**B.Sc. (Ag), HORT**
Curriculum level					Applied and Innovative skills based	**Student specific course outcome**	Research Placement Entrepreneurship

Objective: To provide hands on training on various mass multiplication methods of different horticultural Crops and commercial nursery management

Course outcomes: Through this course students will be able to:

CO-1	Describe the importance and scope Commercial Nursery in horticultural Crops
CO-2	Explain the suitability of Multiplication methods in different horticultural crops
CO-3	Demonstrate various plant propagation techniques in the field
CO-4	Analyse the challenges of commercial nursery establishment and management along with the possible practical solutions
CO-5	Evaluate the role of PGR and media in mass multiplication of horticultural crops

Modules detail:

Module No.	**Module Title**	**Assessment tools**
Module-01	Design/layout of commercial nursery and preparation of nursery beds	• Students' progress will be assessed comprehensively through continuous evaluation process. • Modules/Practicals outcomes based evaluation
Module-02	Preparation of various growing medias	
Module-03	Enrichment of growing medias with various amendments	
Module-04	Nursery raising of various horticultural crops	
Module-05	Mass multiplication of various horticultural crops through cuttings	
Module-06	Hands on practices on layering and stooling	
Module-07	Hands on practices on various methods of budding and grafting	

Module-08	Marketing of nursery plants and seedlings	• Attendance • Presentation and report submission
Module-09	On field survey on present status and future prospects of farm based plant nursery entrepreneurs in gird regions	
Module-10	Exposure visits to commercial nurseries and tissue culture laboratories	
Suggested reading:	1. Jitendra Singh, 2012. Basic Horticulture. Kalyani Publishers. New Delhi. 2. Kumar, N. 1997. Introduction to Horticulture. Rajyalakshmi Publications, Nagorcoil, Tamilnadu. 3. Randhawa, G.S. and Mukhopadhyaya, A. 1994. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi 4. Chadha, K.L. 2019. Handbook of Horticulture (Vol-I). ICAR, New Delhi.	
Suggested e-resources (Websites/e-books)	1. https://ciah.icar.gov.in/publication/Technical_bulletin/2018/production_of_quality_seed.pdf 2. http://www.msmedi-chennai.gov.in/GARMS_Admin/basictools/images/ProjectProfiles/FruitNursery.pdf 3. https://ncert.nic.in/vocational/pdf/kegr102.pdf 4. https://www.researchgate.net/publication/303802886_Nursery_management_in_horticultural_crops_-Compendium 5. http://www.cazri.res.in/publications/PRathaKrishnan.pdf https://sph.iihr.res.in/control/event_pdf/1052117067Proceedings%20%20of%20National%20Conference%20on%20PQSPM.pdf	