



School of Agriculture
B. Sc. (Hons.) Agriculture
4 Year Degree Programme

- Scheme of Examination
- Detailed Syllabi

University Campus:
Patauda, Jhajjar, Haryana, 124108

Courses Outcomes (COs)

The graduate attributes of B.Sc. Agriculture Science is the summation of the expected course learning outcomes mentioned at the end of each course. Some of them are stated below.

CO1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of a B.Sc. programme and understanding of one or more disciplines which form a part of an undergraduate programme of study.

CO2: Critical Thinking: Ability to employ critical thinking in understanding the concepts in every area of the B.Sc. programme.

CO3: Analytical Reasoning: Ability to analyze the results and apply them to various problems appearing in different courses.

CO4: Research-related skills: Develop a sense of inquiry and capability for asking relevant and intelligent questions, problematizing, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

CO5: Problem Solving: Capability to solve problems by using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

CO6: Usage of Modern Tools (Information/digital literacy): Create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modelling to complex science activities with an understanding of the limitations.

CO7: Self-directed learning: Ability to work independently and do an in-depth study of various notions of courses of B.Sc. Programme.

CO8: Communication skills: i. Ability to communicate various concepts of the B.Sc. programme effectively using examples and their geometrical visualizations.

ii. Ability to use courses as a precise language of communication in other branches of human knowledge.

iii. Ability to communicate long-standing unsolved problems in Agriculture.

iv. Ability to show the importance of their courses of B.Sc. as the precursor to various scientific developments since the beginning of civilization.

CO9. Environment and sustainability: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

CO10: Team work and Life long Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

CO11: Moral and ethical awareness: Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of the programme.

CO12. Leadership Qualities and Entrepreneurship: Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination smoothly and efficiently.

PROGRAMME LEARNING OUTCOMES (POs)

Students graduating with the B.Sc. Agriculture Science degree should be able to acquire.

PO1: Agricultural knowledge: Discuss and know the natural resource management including soil, water, nutrient crop production system of field & horticultural crops, plant protection against insect pests, and diseases, crop improvement using conventional plant breeding methods and modern biotechnology, agricultural economics, forestry and agricultural extension among farmers and rural sociology for solve the agriculture problems.

PO2: Critical reflection: Demonstrate an ability to engage in critical thinking by analyze situations, survey and selecting viable solutions.

PO3: Analytical reasoning: Calculate, compare and analyze the results and apply them in various problems appearing in different courses in agriculture for solving agriculture problems.

PO4: Research and project management: Demonstrate knowledge and understanding of agricultural research and apply these to one's work, as a member and leader in a team, to manage projects and finance in multidisciplinary environments.

PO5: Problem solving: Identify, formulate, review the problems and solve them with the help of production and protection principles of agricultural sciences.

PO6: Modern tools: Create, select and apply appropriate techniques, resources and modern agricultural engineering and IT tools including prediction and modelling to complex agricultural activities with an understanding of the limitations.

PO7: Self-directed learning: Determine the ability to engage in independent and daily experience learning in the broadest context of socio-technological changes.

PO8: Communication skill: Generate effective objectives as a member or leader in diverse teams and in multidisciplinary settings for the overall development of the group and communicate effectively on complex agricultural activities with the agricultural community and with society for transfer of technology and knowledge for effective report and design documentation, make effective presentations, and give and receive clear instructions.

PO9: Environment and sustainability: Interpret the issues of environment context and sustainable development.

PO10: Teamwork and Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context to technological changes.

PO11: Ethics: Report different value systems including your own, interpret the moral view of your decisions, and accept responsibility for them.

PO12: Entrepreneurship: Plans, implements, operates and assumes financial risks in farming activities, start-ups and agri-business management or agriculture business.

Annexure I
School of Agriculture
B. Sc. (Hons.) Agriculture

Semester-I

Theory Papers			Marks Allocation			Credit	
			Theory		Practical/ Assignment		Total
Subject Code	Subject Name	Type	Internal	External			
010101001	Fundamentals of Horticulture	Core	30	50	15+5	100	2(1+1)
010101002	Fundamentals of Plant Biochemistry and Biotechnology	Core	30	50	15+5	100	3(2+1)
010101003	Fundamentals of Soil Science	Core	30	50	15+5	100	3(2+1)
010101004	Introduction to Forestry	Core	30	50	15+5	100	2(1+1)
010101005	Comprehension & Communication Skills in English	AECC	30	50	15+5	100	2(1+1)
010101006	Fundamentals of Agronomy	Core	30	50	15+5	100	4(3+1)
010101007A	Introductory Biology*	AECC	30	50	15+5	100	2(1+1) *
010101007B	Elementary Mathematics*	AECC	40	50	0+10	100	2(2+0) *
010101008	Agricultural Heritage	Core	40	50	0+10	100	1(1+0)
010101009	Rural Sociology & Educational Psychology	Core	40	50	0+10	100	2(2+0)
010101010	Human values and Ethics (Non Gradial)**	Generic	...	...	...	Satisfactory	1(1+0)**
010101011	NSS/NCC/Physical Education & Yoga Practices (Non Gradial)**	Generic	...	...	...	Satisfactory	2(0+2)**
TOTAL			290/ 300	450	55/60	900	24 (18+3*+3**)

Subject Codes AG 110 and AG 111 are Non Gradial subjects hence marks will not be added in Semester Total marks.

Only will be remarked as **SATISFACTORY/UNSATISFACTORY.

**Non Gradial Course: Satisfactory/Unsatisfactory

*R: Remedial Course

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately, 40% in individual subject and 50% marks in semester aggregate.

Semester-II

Theory Papers			Marks Allocation				
			Theory		Practical/ Assignment	Total		Credit
Subject Code	Subject Name	Type	Internal	External			
010102001	Fundamentals of Genetics	Core	30	50	15+5	100	3(2+1)
010102002	Agricultural Microbiology	Core	30	50	15+5	100	2(1+1)
010102003	Introductory Soil and Water Conservation Engineering	Core	30	50	15+5	100	2(1+1)
010102004	Fundamentals of Crop Physiology	Core	30	50	15+5	100	2(1+1)
010102005	Fundamentals of Agricultural Economics	Core	40	50	0+10	100	2(2+0)
010102006	Fundamentals of Plant Pathology	Core	30	50	15+5	100	4(3+1)
010102007	Fundamentals of Entomology	Core	30	50	15+5	100	4(3+1)
010102008	Fundamentals of Agricultural Extension Education	Core	30	50	15+5	100	3(2+1)
010102009	Communication Skills and Personality Development	AECC	30	50	15+5	100	2(1+1)
TOTAL			280	450	170 (120+50)	900	24

Note: To pass, a student must obtain a minimum of 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Semester-III

Theory Papers			Marks Allocation				
			Theory		Practical/ Assignment	Total		Credit
Subject Code	Subject Name	Type	Internal	External			
010103001	Crop Production Technology – I (Kharif crops)	Core	30	50	15+5	100	3(2+1)
010103002	Fundamentals of Plant Breeding	Core	30	50	15+5	100	3(2+1)
010103003	Agricultural Finance and Co-Operation	Core	30	50	15+5	100	3(2+1)
010103004	Agricultural Informatics	Core	30	50	15+5	100	2(1+1)
010103005	Farm Machinery and Power	Core	30	50	15+5	100	2(1+1)
010103006	Production Technology for Vegetables and Spices	Core	30	50	15+5	100	2(1+1)
010103007	Environmental Studies and Disaster Management	AECC	30	50	15+5	100	3(2+1)
010103008	Statistical Methods	AECC	30	50	15+5	100	2(1+1)
010103009	Livestock and Poultry Management	Core	30	50	15+5	100	4(3+1)
TOTAL			270	450	180 (135+45)	900	24

Note: To pass, a student is required to obtain a minimum of 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Semester-IV

Theory Papers			Marks Allocation				
			Theory		Practical	Total		Credit
Subject Code	Subject Name	Type	Internal	External			
010104001	Crop Production Technology – II (Rabicrops)	Core	30	50	15+5	100	3(2+1)
010104002	Production Technology for Ornamental Crops, MAP and Landscaping	Core	30	50	15+5	100	2(1+1)
010104003	Renewable Energy and Green Technology	Core	30	50	15+5	100	2(1+1)
010104004	Problematic Soils and their Management	Core	40	50	0+10	100	2(2+0)
010104005	Production Technology for Fruit and Plantation Crops	Core	30	50	15+5	100	2(1+1)
010104006	Principles of Seed Technology	Core	30	50	15+5	100	3(1+2)
010104007	Farming System & Sustainable Agriculture	Core	40	50	0+10	100	1(1+0)
010104008	Agricultural Marketing, Trade & Prices	Core	30	50	15+5	100	3(2+1)
010104009	Introductory Agrometeorology & Climate Change	Core	30	50	15+5	100	2(1+1)
Elective (Discipline Centric) Course (anyone`)							
010104010A	Protected Cultivation	Elective (DC)	30	50	15+5	100	3(2+1)
010104010B	Agribusiness Management	Elective (DC)	30	50	15+5	100	3(2+1)
010104010C	Agrochemicals	Elective (DC)	30	50	15+5	100	3(2+1)
010104010D	Commercial Plant Breeding	Elective (DC)	30	50	15+5	100	3(2+1)
010104011	Educational Tour (Non Gradial)**	Generic					2 (0+2)**
Total			320	500	180 (120+60)	1000	25

Note: To pass, a student is required to obtain a minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.Non Gradial Course: Satisfactory/Unsatisfactory**

Semester-V

Theory Papers			Marks Allocation				
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010105001	Principles of Integrated Pest and Disease Management	Core	30	50	15+5	100	3(2+1)
010105002	Manures, fertilizers and Soil Fertility Management	Core	30	50	15+5	100	3(2+1)
010105003	Pests of Crops and Stored Grains and their Management	Core	30	50	15+5	100	3(2+1)
010105004	Diseases of Field and Horticultural Crops and their Management	Core	30	50	15+5	100	3(2+1)
010105005	Crop Improvement-I (Kharif crops)	Core	30	50	15+5	100	2(1+1)
010105006	Entrepreneurship Development and Business Communication	AECC	30	50	15+5	100	2(1+1)
010105007	Geoinformatics and Nanotechnology and Precision Farming	Core	30	50	15+5	100	2(1+1)
010105008	Practical Crop Production – I (Kharif crops)	Core	0	0	100+0	100	1(0+1)
010105009	Intellectual Property Rights	AECC	40	50	0+10	100	1(1+0)
Elective (Discipline Centric) Course (anyone)							
010105010 A	Agricultural Journalism	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 B	Landscaping	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 C	Food Safety and Standards	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 D	Biopesticides & Biofertilizers	Elective (DC)	30	50	15+5	100	3 (2+1)
TOTAL			280	450	270 (220+50)	1000	23

Note: To pass, a student is required to obtain a minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Semester-VI

Theory Papers			Marks Allocation				
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010106001	Rainfed Agriculture & Watershed Management	Core	30	50	15+5	100	2(1+1)
010106002	Protected Cultivation and Secondary Agriculture	Core	30	50	15+5	100	2(1+1)
010106003	Diseases of Field and Horticultural Crops and their Management	Core	30	50	15+5	100	3(2+1)
010106004	Post-Harvest Management and Value Addition of Fruits and Vegetables	Core	30	50	15+5	100	2(1+1)
010106005	Management of Beneficial Insects	Core	30	50	15+5	100	2(1+1)
010106006	Crop Improvement-II (Rabi crops)	Core	30	50	15+5	100	2 (1+1)
010106007	Practical Crop Production – II (Rabi crops)	Core	0	0	100	100	1(0+1)
010106008	Principles of Organic Farming	Core	30	50	15+5	100	2(1+1)
010106009	Farm Management, Production & Resource Economics	Core	30	50	15+5	100	2(1+1)
010106010	Principles of Food Science & Nutrition	Core	40	50	0+10	100	2(2+0)
Elective (Discipline Centric) Course (anyone)							
010106011A	Weed Management	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011B	Micro Propagation Technologies	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011C	Hi-Tech Horticulture	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011D	System Simulation and Agro-Advisory	Elective (DC)	30	50	15+5	100	3 (2+1)
TOTAL			310	500	290 (235+55)	1100	23

Note: To pass, a student is required to obtain a minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Semester-VII

*Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)

Theory Papers			Marks Allocation (Tentative)				
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010107001	General Orientation & on-campus training by different faculties	SEC/VOC	0	0	50	50	14
010107002	Village Attachment and Swachh Bharat Abhiyan Activities	SEC/VOC	0	0	400	400	
010107003	Unit attachment in University/College. KVK/Research Station	SEC/VOC	0	0	250	250	
010107004	Plant Clinic	Core	0	0	100	100	2
010107005	Agro-Industrial Attachment	SEC/VOC	0	0	150	150	4
010107006	Project Report Preparation, Presentation and Evaluation	SEC/VOC	0	0	50	50	-
TOTAL			0	0	1000	1000	20

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately,

40% in individual subjects and 50% marks in semester aggregate.

Semester-VIII

Theory Papers			Marks Allocation				
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010108001	Production Technology for Bioagents and Biofertilizer	SEC/VOC	0	0	100	100	0+10
010108002	Seed Production and Technology	SEC/VOC	0	0	100	100	0+10
010108003	Mushroom Cultivation Technology	SEC/VOC	0	0	100	100	0+10
010108004	Soil, Plant, Water and Seed Testing	SEC/VOC	0	0	100	100	0+10
010108005	Commercial Beekeeping	SEC/VOC	0	0	100	100	0+10
010108006	Poultry Production Technology	SEC/VOC	0	0	100	100	0+10
010108007	Commercial Horticulture	SEC/VOC	0	0	100	100	0+10
010108008	Floriculture and Landscaping	SEC/VOC	0	0	100	100	0+10
010108009	Food Processing	AECC	0	0	100	100	0+10
010108010	Agriculture Waste Management	SEC/VOC	0	0	100	100	0+10
010108011	Organic Production Technology	SEC/VOC	0	0	100	100	0+10
010108012	Commercial Sericulture	SEC/VOC	0	0	100	100	0+10
010108013	Agri-Business Management	AECC	0	0	100	100	0+10
010108014	Agro-Advisory Services	SEC/VOC	0	0	100	100	0+10
010108015	Nursery Management	SEC/VOC	0	0	100	100	0+10
TOTAL			0	0	200	200	0+20
<p>Note: Modules for Skill Development and Entrepreneurship: A student shall register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in semester VIII.</p>							
Note:-	(i)	All courses are compulsory total having 183 credits.					

Note: To pass, a student is required to obtain a minimum of 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Annexure II
B. Sc. (Hons.) Agriculture
Semester-I

Theory Papers			Marks Allocation			Total	Credit
			Theory		Practical/ Assignment		
Subject Code	Subject Name	Type	Internal	External			
010101001	Fundamentals of Horticulture	Core	30	50	15+5	100	2(1+1)
010101002	Fundamentals of Plant Biochemistry and Biotechnology	Core	30	50	15+5	100	3(2+1)
010101003	Fundamentals of Soil Science	Core	30	50	15+5	100	3(2+1)
010101004	Introduction to Forestry	Core	30	50	15+5	100	2(1+1)
010101005	Comprehension & Communication Skills in English	AECC	30	50	15+5	100	2(1+1)
010101006	Fundamentals of Agronomy	Core	30	50	15+5	100	4(3+1)
010101007 A	Introductory Biology*	AECC	30	50	15+5	100	2(1+1) *
010101007 B	Elementary Mathematics*	AECC	40	50	0+10	100	2(2+0) *
010101008	Agricultural Heritage	Core	40	50	0+10	100	1(1+0)
010101009	Rural Sociology & Educational Psychology	Core	40	50	0+10	100	2(2+0)
010101010	Human Values and Ethics (Non Gradial)**	Generic	...	...	...	Satisfactory	1(1+0)**
010101011	NSS/NCC/Physical Education & Yoga Practices (Non Gradial)**	Generic	...	...	...	Satisfactory	2(0+2)**

Subject Codes AG 110 and AG 111 are Non Gradial subjects hence marks will not be added in Semester Total marks.

Only will be remarked as **SATISFACTORY/UNSATISFACTORY.

**Non Gradial Course: Satisfactory/Unsatisfactory

*R: Remedial Course

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

010101001	Fundamentals of Horticulture	2(1+1)
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Course objective-

- To learn about the inception of horticulture and its distinguishing features.
- To know about the various branches of horticulture.
- To study the propagation methods of ornamental plants.
- To provide employment, often in rural areas.

Theory

- UNIT-A Horticulture- Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops.
- UNIT-B Plant propagation methods and propagating structures; Seed dormancy, Seed germination.
- UNIT-C Principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.
- UNIT-D Pollination, pollinizers and pollinators, fertilization and parthenocarpy, medicinal and aromatic plants.
- UNIT-E Importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical:

- Identification of Garden Tools.
- Identification of horticultural crops.
- Preparation of seed bed/ nursery bed.
- Practice of sexual and asexual methods of propagation including micro propagation.
- Layout and planting of orchard.
- Training and pruning of fruit trees.
- Preparation of potting mixture.
- Fertilizer application in different crops.
- Visits to commercial nurseries/orchards.

Reference:

1. Chada, K.L. (2002) Handbook of Horticulture, ICAR, New Delhi.
2. Neeraj Pratap Singh (2005) Basic concepts of Fruit Science, IBDC Publishers
3. Jitendra Singh (2011) Basic Horticulture, Kalyani Publications, New Delhi.

Course Objective:

- To understand the concept of biochemistry and their importance
- To study the bimolecular and their importance
- To study the pathways of bimolecular synthesis and metabolism
- To understand the concept of plant tissue culture
- To know the techniques in plant tissue culture
- To understand the gene transformation methods
- To know the concepts of MAS

Theory

- UNIT-A 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 Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.
- UNIT-B Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.
- UNIT-C Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.
- UNIT-D 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 cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation;
- UNIT-E Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

010101003	Fundamentals of Soil Science	3(2+1)
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Course Objective:

- To understand basic concept regarding Pedological and edaphological concept of soil and soil genesis.
- Effect of soil properties on plant nutrition, plant growth and crop production.
- To know the beneficial and harmful effects of macro and micronutrients on plant growth.

Theory

- UNIT-A Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity;
- UNIT-B Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth,
- UNIT-C 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;
- UNIT-D 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;
- UNIT-E Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in the field. Study of soil sampling tools, collection of representative soil samples, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of the organic matter content of the soil.

References:-

1. Boul S.W., Hole R.D., Mc Cracken and Southard R.J. (1998). Soil genesis and classification Fourth Ed Panima Publishing corporation, New delhi.
2. Baver, L.D. Gardener, W.H. and gardener W.R. (1976) Soil Physics Wiley Eastern Ltd, New Delhi
3. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science. Tata McGraw Hill publishing Co.Ltd, New Delhi
4. Brady, N.C. and Weil, R.R. (2002) The nature and properties of soils, prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi
5. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi

6. Mehra R.K. (2004) Text book of Soil Science, ICAR, New Delhi
7. ISSS (2009) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi
8. Chopra S.L. and Kanwar, J.S. (1991) Analytical Agricultural Chemistry, Kalyani publisher, Ludhiana
9. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi
10. Piper, C.S. (1950) Soil and plant analysis. Hans publications, Bombay
11. Richards, L.A. (1960) Diagnosis and improvement of saline and alkali soils., USDA agriculture Handbook 60, Washington D.C., USA
12. Gupta, I.C. & Sharma, S.K. (1988) Crop production in salt affected soils, Oxford and IBH Publication, New Delhi.
13. Agarwal, R.R., Yadav, J.S.P. & Gupta, R.N. (1982) Saline and alkali soils of India. ICAR, New Delhi.
14. Sehgal, J. (2000) Pedology: Concept and applications, Kalyani publisher, Ludhiana

010101004	Introduction to Forestry	2(1+1)
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Course objective-

- To ensure long-term forest productivity and conservation of forest resources through prompt reforestation, soil conservation, afforestation and other measures.
- To protect water quality in streams, lakes and other water bodies.

Theory

- UNIT-A Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies.
- UNIT-B 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.
- UNIT-C Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method
- UNIT-D 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.
- UNIT-E Agroforestry – definitions, importance, criteria of selection of trees in agro forestry, 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.

Practical

Identification of tree species. Diameter measurements using callipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery layout, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest-based industries.

Course Objectives:

- To develop critical thinking.
- To improve reading skills.
- To recognize and understand meaning of grammatical structure.
- To develop written expression of thoughts and provide opportunities to explore more ideas.
- To recognize, explain and use the rhetorical strategies and the formal elements.

Theory

- UNIT-A War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw.
- UNIT-B Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words.
- UNIT-C Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis
- UNIT-D Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing.
- UNIT-E The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing Interviews: kinds, Importance and process.

Practical

Listening Comprehension: Listening to short talks lectures, and speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

Course Objective

- To study and acquaint with basic knowledge of agriculture and its allied branches.
- To know principles of agriculture practices, modern systems of farming of agricultural crops and best cropping management suitable in local climate.
- To study about importance, classification, crop weeds competition, concepts of weed management principles and methods.
- To study about herbicides concerning classification, selectivity, resistance and allelopathy.

Theory

- UNIT-A Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency
- UNIT-B Water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.
- UNIT-C Weeds- importance, classification, crop weed competition, concepts of weed management principles and methods, herbicides- classification, selectivity and resistance, allelopathy.
- UNIT-D Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles
- UNIT- E Adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agroclimatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one-way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

References:

1. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur
4. Reddy, T. Yellamanda and Reddy, G.H. Sankara. 2016. Principles of Agronomy (2nd edition) ,Kalyani Publishers, Ludhiana
5. Reddy, S.R.2012. Principles of Crop Production (4th edition), Kalyani Publishers, Ludhiana.
6. Gupta, O.P. 2005. Weed Management: Principles and Practices (2nd Ed) Agribios (India) Jodhpur.
7. De, Gopal Chandra 1989, Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.
8. Michael, A.M. 1987. Irrigation - Theory and Practice, Vikas Publishing House Pvt. Ltd., New-Delhi.
9. Mishra, R.D. and Ahmed, M. 1987. Manual on Irrigation Agronomy, Oxford & IBH Publishing Co.Pvt..Ltd., New-Delhi.

0101007A	Introductory Biology*	2(1+1)
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Course objectives:-

- To know the living world and concept of origin of life
- To know the cell and their structure and functions
- To understand the concept of flowers and seed
- To classify the plant family and their characteristics
- To know the role of animals in agriculture

Theory

UNIT-A Introduction to the living world, diversity and characteristics of life, Origin of life, Evolution and Eugenics

UNIT-B Binomial nomenclature and classification Cell and cell division

UNIT-C Morphology of flowering plants. Seed and seed germination

UNIT-D Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae

UNIT-E Role of animals in agriculture. *e ICAR Fifth Deans' Committee*

Practical

Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flowers and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

010101007B	Elementary Mathematics*	2(2+0)
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Course Objectives

- To learn about straight lines and circles.
- To apply knowledge of basic geometry skills to solve problems.
- To know about both differential and integral calculus.
- To develop the skills to apply the concepts of calculus to solve practical problems
- To learn, understand and apply the concepts and skill of matrices theory.

Theory

UNIT-A 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,

UNIT-B Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, and Area of triangle and quadrilateral.

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 the line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

UNIT-C Differential Calculus: Definition of function, limit and continuity, Simple problems on the limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it.

UNIT-D Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it). Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method,

UNIT-E Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it). Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

010101008	Agricultural Heritage	1(1+0)
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Course Objectives:

- To know Agriculture in India - way of life and not an occupation.
- To increase awareness of the rich heritage of Indian agriculture which is unique than any other civilization.
- To implant a sense of pride amongst the people, particularly agriculture students as our agriculture has sustainable practices for generations.
- To stimulate scientific research based on traditional technology.

Theory

- UNIT-A Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture;
- UNIT-B Past and present status of agriculture and farmers in society ;Journey of Indian agriculture and its development from past to modern era;
- UNIT-C Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world;
- UNIT-D Agriculture scope; Importance of agriculture and agricultural resources available in India;
- UNIT-E Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

References:

1. ICAR 1989 Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
2. Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri- Histroy Foundation, Secunderabad, Andhra Pradesh.
3. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. 2009. A Textbook on Ancient History of Indian Agriculture, Munshiram Manoharial Publishers Pvt. Ltd,
4. Nene, Y.L., Choudhary, S.L. and Saxena, R.C. 2010. Textbook on Ancient History of Indian Agriculture, Asian Agri-History Foundation.
5. D. Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.
6. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi. (<http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf>)

010101009	Rural Sociology & Educational Psychology	2 (2+0)
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Course Objectives:

- To impart knowledge to the students on sociological and psychological aspects of rural people and to acquaint with some important features of rural society,
- To the helps in devising an agricultural extension plans for farmers.

Theory

UNIT-A Sociology and Rural sociology: Definition and scope, its significance in agriculture extension.

UNIT-B Social ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

UNIT-C Educational psychology: Meaning & its importance in agriculture extension.

UNIT-D Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation.

UNIT-E Theories of Motivation, Intelligence.

Suggested readings

1. Chidambaram, J.B. 1973. Introductory rural sociology. New York, John Wiley and Sons.
2. Desai, A.R. 1978. Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Doshi, S.L. 2007. Rural sociology. Rawat Publishers, Delhi.
4. Jayapalan, N. 2002. Rural sociology. Altanic Publishers, New Delhi.
5. Sharma, K.L. 1997. Rural society in India. Rawat Publishers, Delhi.
6. Bhatia, H.R. 1965. A Text Book of Educational Psychology, Asia Publishing House, New Delhi.
7. Pujari, D. 2002. Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur
8. Bhushan, V. and Sachdeva, D.R. 2010. An introduction to Sociology, Kitab Mahal, New Delhi.
9. Rao, C.N.S. 2015. Sociology, S. Chand & Company, New Delhi.
10. Maslow, A.H. (1970) Motivation and personality. Harper and Row publishers, New York.

010101010	Human Value and Ethics (Non Gradial)	1 (1+0)
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Course Objectives:

- To know the importance of goal, mission and vision of life.
- To know the process of human conduct and human character.
- To define the goal and objectives of life.
- To develop the heart and cleanse the mind.
- To improve the spiritual intelligence.

Theory

UNIT-A Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life.

UNIT-B Principles and Philosophy Self Exploration. Self Awareness. Self Satisfaction.

UNIT-C Decision Making, Motivation, Sensitivity.

UNIT-D Success. Selfless Service Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul.

UNIT-E Attachment and Detachment. Spirituality Quotient. Examination.

010101011	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)
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Course Objective

- To introduce the basic concept of NSS, Orientation, NSS programmes and activities.
- To understand community mobilization, Social harmony and national integration.
- To know the family and society values, Volunteerism, shramdan, Citizenship, constitution and human rights.
- To understand the role of youth leadership and Life competencies.
- To arrange documentation and data report.
- To demonstrate the activities directed by the Central and State Government

Theory

UNIT- A Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme. all the activities related to the National Service Scheme course is distributed under four different courses viz.

UNIT- B National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load.

UNIT- C Development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society. The entire four courses should be offered continuously for two years.

UNIT- D A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one-day camps in a year and one special camp for 7 days at any semester break period in the two years.

References:

1. National Service Scheme: A Report, by Khwaja GhulamSaiyidain. Published by Ministry Of Education, Govt. of India, 1961.
 2. Training and consultancy needs in national service scheme, by N. F. Kaikobad, Krishan K. Kapil. Published by Tata Institute of Social Sciences, 1971.
 3. National Service Scheme: guide-lines to project-masters, by Andhra University, Dept. of Sociology & Social Work. Published by Dept. of Sociology & Social Work, Andhra University, 1971.
 4. National Service Scheme in Gujarat: An Evaluation Report for the Year 1986-87, by Tata Institute of Social Sciences Training Orientation & Research Centre (NSS), India, India. Dept. of Youth Affairs and Sports. Published by The Centre, 1987.
 5. National Service Scheme in Maharashtra: An Evaluation Report for the Year 1986-87, by Tata Institute of Social Sciences Training Orientation & Research Centre (NSS), India, India Dept. of Youth Affairs and Sports. Published by The Centre, 1988.
- National Service Scheme in India: A Case Study of Karnataka, by M. B. Dilshad. Published by Trust Publications, 2001.

Semester-II

Theory Papers			Marks Allocation			Total	Credit
			Theory		Practical/ Assignment		
Subject Code	Subject Name	Type	Internal	External			
010102001	Fundamentals of Genetics	Core	30	50	15+5	100	3(2+1)
010102002	Agricultural Microbiology	Core	30	50	15+5	100	2(1+1)
010102003	Introductory Soil and Water Conservation Engineering	Core	30	50	15+5	100	2(1+1)
010102004	Fundamentals of Crop Physiology	Core	30	50	15+5	100	2(1+1)
010102005	Fundamentals of Agricultural Economics	Core	40	50	0+10	100	2(2+0)
010102006	Fundamentals of Plant Pathology	Core	30	50	15+5	100	4(3+1)
010102007	Fundamentals of Entomology	Core	30	50	15+5	100	4(3+1)
010102008	Fundamentals of Agricultural Extension Education	Core	30	50	15+5	100	3(2+1)
010102009	Communication Skills and Personality Development	AECC	30	50	15+5	100	2(1+1)
TOTAL			280	450	170 (120+50)	900	24

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately, 40% in individual subject and 50% marks in semester aggregate.

010102001	Fundamentals of Genetics	3(2+1)
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Course objectives:

- To identify the process and purposes of cell cycle.
- To solve the genetics transmission problems.
- To understand the role of nucleic acid in the transport of genetic information.
- To understand the functions of cells.

Theory

- UNIT-A 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.
- UNIT-B Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudo alleles.
- UNIT-C Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics.
- UNIT-D Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance.
- UNIT-E Genetic disorders. 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.

Practical

Study of the microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two-point test cross and three-point test cross data). Study on sex-linked inheritance in *Drosophila*. Study of models on DNA and RNA structures.

Reference books:

1. Gupta P.K.2004. Cytology, Genetics and evolution. Rastogi Publications, Meerut. (Hindi Edition)
2. Klug, W.W. and Cummings, M.R.2005. Concepts of genetics Pearson Education (Singapore) pvt.Ltd., Indian Branch, Pratap Ganj, New Delhi.
3. Singh, B.D. 2001. Kalyani Publishing House, New Delhi.
4. Strickberger, M.W.2001. Genetics. Prentice Hall of India. Pvt. Ltd., New Delhi.

010102002	Agricultural Microbiology	2(1+1)
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Course Objectives

- To acquaint and enrich the students with the knowledge on basic and applied aspects of microbial inoculants
- To impart knowledge about production of beneficial microorganisms and their impact on crop production.
- To study the role of microbes in enhancing soil fertility.
- To study the use of the microbes in agriculture.

Theory

- UNIT-A Introduction Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.
- UNIT-B Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposing.
- UNIT-C Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles.
- UNIT-D Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue-green algae and mycorrhiza. Rhizosphere and phyllosphere.
- UNIT-E Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of Rhizobium from legume root nodule. Isolation of Azotobacter from soil. Isolation of Azospirillum from roots. Isolation of BGA. Staining and microscopic examination of microbes.

References:

1. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.
3. Pelczar, Jr. Michel J. Chan, E.C.S. and Krieg, Noel R. 1997. Microbiology. Tata McGraw -Hill Edition, 1993. India.
4. Rangaswami, G. and Bagyaraj, D.J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
5. Rao, N.S. 2000. Soil Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Vishunavat, K. and Kolte, S.J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi
7. Sharma, P.D. 2010. Microbiology. 3rd edition Rastogi Publishers, Meerut
8. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
9. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.

010102003	Introductory Soil and Water Conservation Engineering	2(1+1)
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Course Objective:

- To understand the degradation of productive soil and its effect.
- To know the causes of water scarcity and their solution to fight against the evil effects through soil and water conservation technologies.
- To provide knowledge about various centrifugal pumps and pressurized irrigation methods.

Theory

UNIT-A Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion.

UNIT-B Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques.

UNIT-C Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing.

UNIT-D Grassed waterways and their design. Water harvesting and its techniques.

UNIT-E Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed waterways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem with wind erosion.

References:

1. Land and Water Management Engineering. 1982. Murthy V.V.N. Kalyani Pubhliers, New Delhi.
2. Irrigation: Theory and Practices.2012. Michael A.M. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Principles of Agricultural. Engineering. Vol. II. 2012. Michael A.M. and T.P. Ojha. Jain Brothers, New Delhi.
4. Soil and Water Conservation Water Management. 2010. Mahnot, S.C., Singh P.K. and Chaplot, P.C. Apex Publication House, Udaipur.

010102004	Fundamentals of Crop Physiology	2(1+1)
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Course Objective

- To understand the basic concepts of plant physiology
- To know the structure and functions of plant cell
- To understand the role of nutrients in plant cell
- To understand the metabolism pathways
- To understand the plant growth and analysis.
- To understand the role of growth hormone

Theory

- UNIT-A Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology;
- UNIT-B Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms;
- UNIT-C Photosynthesis: Light and Dark reactions, C₃, C₄ and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain;
- UNIT-D Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses.
- UNIT-E Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Study of plant cells, structure and distribution of stomata, imbibition, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra-Red Gas Analyzer (IRGA).

Reference books:

1. S. N. Pandey and B. K. Sinha.1977. Plant Physiology. Vikas Publishing House Pvt.Ltd, New Delhi.
2. A. Kumar and S. S. Purohit,1998. Plant Physiology Fundamental and Application. Agrobotanica 4E 176 J.N. Vyas Nagar, Bikaner.
3. N.K. Gupta and S. Gupta. 2005. Plant Physiology. Oxford & IBH, New Delhi.
4. M. Bala, S. Gupta and N. K. Gupta.2013.Practicals in Plant Physiology. Scientific publisher,Jodhpur.
5. D. L. Bagdi. 2016.Crop Physiology. New India Publishing Agency, New Delhi.

010102005	Fundamentals of Agricultural Economics	2(2+0)
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Course objective-

- To acquaint the learner with introductory Agricultural Economics, development. Agriculture in India, use of yield increasing inputs, marketing and prices
- To provide students with state-of-the-art knowledge from a multidisciplinary field which integrates topics from agriculture and economics.
- To highlight the importance of agriculture in economic development.
- To understand the current developments in the agriculture sector.
- To provide a detailed treatment of issues in agricultural economics.

UNIT-A 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, the 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.

UNIT-B Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, the 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.

UNIT-C 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. 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.

UNIT-D Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. 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.

UNIT-E 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.

References:

1. K.K. Dewett and J.D. Verma (1986) Elementary Economic Theory, S. Chand & Company, New Delhi
2. S.K. Mishra and V.K. Puri (1996) Indian Economy, Himalaya Publishing House, New Delhi
3. G.B. Jakhhar and S.G. Beri (1996) Elementary Principles of Economics, Oxford University Press (10th Edition), Delhi
4. Berkeley Hill (1980) An Introduction to Economics for students of agriculture, Pergaman Press, Oxford
5. B.L. Gupta (1996) Introduction to Economic Theory, Arya Book Depot, New Delhi

Course objectives

- To acquaint with different strategies for disease management.
- To know the epidemiological factors for disease development.
- To know about plant disease forecasting.

Theory

- UNIT-A 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. Pathogenesis. Causes/factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases.
- UNIT-B Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes. Deans' Committee
- UNIT-C Fungi: general characters, the 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. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.
- UNIT-D Viruses: nature, structure, replication and transmission. Study of phanerogamic plantparasites. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.) Growth and reproduction of plant pathogens. Liberation/dispersal and survival of plant pathogens.
- UNIT-E 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. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipment and microscopy. Collection and preservation of disease specimens. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. The study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

References:

1. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Alexopolus, C.J., Mims, C.W. and Blackwell, M. 2013. Introductory Mycology. John Wiley Eastern Private Limited, New York.
3. Mehrotra, R.S. and Agrawal, A. 2013. Plant Pathology. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Singh, R.S. 2011. Introduction to Principles of Plant Pathology. 4th ed. Oxford & IBH Publishing Company. New Delhi.
5. Nene Y.L. and Thapliyal, P.N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
6. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
7. Dube, H.C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur
8. Dube, H.C. 2013, An Introduction to Fungi. 4th ed. , Scientific Publishers India, Jodhpur.

Theory

Course Objective-

- To know about fundamental concepts and information about Phylum Arthropoda and its classes.
- To understand basic insect morphology and biology for effective pest management.
- To have a deeper understanding of several aspects of taxonomy and binomial nomenclature of agricultural importance related insect orders.

Theory

UNIT-A History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

UNIT-B 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.

UNIT-C 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, anti-feedants, hormones, attractants, gamma radiation. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

UNIT-D Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae.

UNIT-E Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of

digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Suggested Readings

1. Chapman .R.F.1981. Insect Structure and Function, ELBS Publishers New Delhi.
2. David B.V. and Ananthkrishnan .T.N. 2003. General and Applied Entomology, 2nd Ed. Mc graw Hill publishing Co. Ltd. New Delhi.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. Pant. N.C. and Ghai, S. 1981. Insect Physiology and Anatomy, ICAR, New Delhi.
5. Richards O.W. and Davies R.G. 1977. Imm's General Text Book of Entomology, Vol. I & II. Chapman and Hall, London.
6. Snodgrass R.E .2001. Principles of Insect Morphology, CBS Publishers and Distributors, New Delhi.

010102008	Fundamentals of Agricultural Extension Education	3(2+1)
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Theory

Course Objectives:

- To provide the farmers the knowledge and help that will enable him to farm more efficiently and to increase his income.
- To help in planning and implementing the family and village plans for increasing production in various occupations
- To provide facilities for better family living.
- To encourage the farmer to grow his own food. Eat well and living well.
- To promote better social, natural, recreational, intellectual and spiritual life among the people.

Theory

UNIT-A 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. 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.);

UNIT-B Various extension/ agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

UNIT-C Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.

UNIT-D 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, ICT Applications in TOT (New and Social Media), media mix strategies.

UNIT-E Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio-visual equipment and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro-teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; 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: 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.

Suggested readings

1. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.
2. Dahama, O. P. and Bhatnagar, O. P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
3. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
4. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
5. Rathore, O. S. et al., 2012, Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
6. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
7. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech PublishingAcademy, Udaipur.
8. Van Den Ban, A. W. and Hawkins, H. S., Agricultural Extension, S. K. Jain for CBS Publishers & Distributors, New Delhi.
9. Debabrata Das Gupta. Extension Education. Agrobios (India), Agro house behind Nasrani Cinema, Chaupasani Road, Jodhpur- 342402, Phone -0291-2642319, Fax- 0291-2643993, Email- agrobios@sify.com
10. Sharma, O. P. & Somani, L. L. 2012. Dimension of Agricultural Extension, Agrotech Publishing Academy. Udaipur.

010102009	Communication Skills and Personality Development	2(1+1)
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Course Objectives:

- To know the value of communication in personal & professional success.
- To Develop awareness and Adapt appropriate communication strategies.
- To Justify and Illustrate messages with a specific intent.
- To Explain and evaluate the use of primary academic writing associated with the communication discipline
- To Describe and apply knowledge of human communication and language processes as they occur across various contexts.

Theory

UNIT-A Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication;

UNIT-B Listening and note taking, writing skills, oral presentation skills;

UNIT-C Field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles,

UNIT-D Precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking;

UNIT-E Group discussion. Organizing seminars and conferences.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Suggested readings:

1. Sandhu, A. S. (1999). Textbook on Agricultural Communication; process and methods oxfordRIBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. (1960). The process of Communication. Nw Yark, Holt, Rinehart and WinstonInc.
3. Dahama, O. P. and Bhatnagar, O.P., 1998, Education and Communication for Development,Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education andManagement in Extension, Concept publishing company, New Delhi.
5. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers,Ludhiana {7th revised edition - 2010}.
6. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech PublishingAcademy, Udaipur.
7. M Hilaris 2011. Indian agriculture and information and communication technology (ICT): Soundari,New century Publications, Carnegie,
8. Dale. 2012. How to Win Friends and Influence People in the Digital Age. Simon & Schuster.
9. Covey Stephen R. 1989. TheSeven Habits of Highly Successful People. Free Press.
10. Verma, K.C. 2013. The Art of Communication. Kalpaz.
11. Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan IndiaLtd. New Delhi.
12. Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill
13. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.

Semester-III

Theory Papers			Marks Allocation				
			Theory		Practical/ Assignment	Total		Credit
Subject Code	Subject Name	Type	Internal	External			
010103001	Crop Production Technology – I (Kharif crops)	Core	30	50	15+5	100	3(2+1)
010103002	Fundamentals of Plant Breeding	Core	30	50	15+5	100	3(2+1)
010103003	Agricultural Finance and Co-Operation	Core	30	50	15+5	100	3(2+1)
010103004	Agricultural Informatics	Core	30	50	15+5	100	2(1+1)
010103005	Farm Machinery and Power	Core	30	50	15+5	100	2(1+1)
010103006	Production Technology for Vegetables and Spices	Core	30	50	15+5	100	2(1+1)
010103007	Environmental Studies and Disaster Management	AECC	30	50	15+5	100	3(2+1)
010103008	Statistical Methods	AECC	30	50	15+5	100	2(1+1)
010103009	Livestock and Poultry Management	Core	30	50	15+5	100	4(3+1)
TOTAL			270	450	180 (135+45)	900	24

Note: To pass, a student is required to obtain a minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

010103001	Crop Production Technology – I (Kharif crops)	3 (2+1)
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Course Objectives

- To acquaint the students with the economic importance of major kharif crops.
- To know the impact of different soil and climatic parameters in relation to crop production.
- To transmit the technical knowhow / production technology of major kharif crops.
- To demonstrate the practical field exercise for different crops i.e. seed bed / nursery preparation, transplanting sowing, weeding, manuring, irrigation and harvesting etc.
- To identify the kharif crops weeds, characteristics, and their control management.

Theory

UNIT- A Origin, geographical distribution, economic importance of Kharif Crop.

UNIT- B Soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops.

UNIT- C Agronomical practices for Kharif Cereals – rice, maize, sorghum, pearl millet and finger millet.

UNIT- D Agronomical practices for Kharif pulses -pigeon pea, mungbean and urdbean and Oilseeds Crops- Groundnut, and soybean.

UNIT-E Cultural Practices for fibre crops- cotton & Jute and forage crops-sorghum, cowpea, cluster bean and Napier.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of Kharif season crops, effect of sowing depth on germination of Kharif crops, identification of weeds in Kharif season crops, top dressing and foliar feeding of nutrients, the study of yield contributing characters and yield calculation of Kharif season crops, the study of crop varieties and important agronomic experiments at the experimental farm. study of forage experiments, morphological description of Kharif season crops, and visit to research centres of related crops.

References:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Singh, S. S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), KalyaniPublishers, New Delhi, Kalyani Publishers, Ludhiana.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Publishers, Ludhiana.

Course objectives:

- To get the higher crop yield.
- To improve the quality of crops.
- To develop resistant varieties.
- To develop the early maturity varieties.

Theory

- UNIT-A 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, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction;
- UNIT-B Centres of origin/diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept.
- UNIT-C Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes-Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties;
- UNIT-D Breeding methods in asexually propagated crops, clonal selection and hybridization; maintenance of breeding records and data collection; Wide hybridization and pre breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses;
- UNIT-E Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

Reference books:

1. Alard, R.W. 2000. Principles of Plant Breeding. John Wiley & Sons, New York.
2. Chahel, G.S. and S.S. Ghosal. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
4. Singh, P. 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.
5. Jain, H. K. and M. C. Kharsckwal. 2004 Plant Breeding- Mendelian to Molecular approach. Narosa Publishing House, New Delhi.

010103003	Agricultural Finance and Co-Operation	3(2+1)
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Course objective-

- To promote the development of agriculture and increase the agricultural production.
- To make students proficient in concepts and techniques of agricultural financial management.
- To priority sector, credit management and financial risk management. ct.
- To expose the students to the various kinds of risk in farming, risk management strategies and mechanisms and insurance policies.

Theory

UNIT-A 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. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks,

UNIT-B. 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,

UNIT-C. Insurance and Credit Guarantee Corporation of India. 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.

UNIT-D. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

UNIT-E. 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.

Practical

Determination of the most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet-A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal. A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and their value-added products. Seminar on selected topics.

References:

1. Reddy, S. and Raghu Ram, P. "Agricultural Finance and Management" Oxford and IBH, New Delhi
2. Singh, J.P. (1990) "Agricultural Finance- Theory and Practice" Ashish Publishing House, New Delhi
3. Pandey, U.K. "An Introduction to Agricultural Finance" Kalyani Publishes, New Delhi
4. Pandey, Mukesh and Tewari, Deepali "Rural and Agriculture Marketing"
5. Mamoria, C.B. "Agricultural Problems of India"
6. Krishnaswami, O.R. "Fundamental of Cooperation"
7. Nelson, A.G. and Murray, W.G. 1988 "Agricultural Finance" IOWA State University Press, Amies, IOWA, USA
8. Johl, S.S. : Essentials of Farm Financial Management, Atlas Books and Periodicals (TTPP)

010103004	Agricultural Informatics	2(1+1)
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Course Objectives:

- To impart the basic concepts of computer systems and all about it.
- To understand the concepts about MS office learning.
- To understand basic concepts about programming languages, Use ICT in agriculture, DSS and expert systems.
- To understand the Computer Models for understanding plant processes

Theory

UNIT-A Introduction to Computers, Anatomy of computer, Operating Systems, definition and type, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture.

UNIT-B World Wide Web (WWW): Concepts and components Introduction to computer programming languages, concepts and standard input/output operations.

UNIT-C e-Agriculture, concepts and applications, Use of ICT in Agriculture Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management.

UNIT-D Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc. Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture.

UNIT-E Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

Practical

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands-on Decision SupportSystem. Preparation of contingent crop planning.

010103005	Farm Machinery and Power	2(1+1)
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Course Objectives:

- To understand the concepts of farm power
- To understand the engines used in farm power
- Get familiarize with tractor, its parts and functionaries
- To understand various implements used at agriculture farm

Theory

- UNIT- A Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines
- UNIT- B Study of different components of I.C. engine, I.C. engine terminology and numerical
- UNIT-C Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system: clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power
- UNIT- D Estimation of field capacity and power requirements of implements Familiarization with Primary and Secondary Tillage implement, implement for intercultural operations
- UNIT- E Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with the clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of the engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow. Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different intercultivation equipment, Familiarization with harvesting and threshing machinery.

Suggested Readings:

1. Principles of Agricultural Engineering. Vol. I. 2012. Michael, A.M. and T.P. Ojha. Jain Brothers, Jodhpur.
2. Farm Tractors, Maintenance and Repair. 1989. Rai and Jain. Tata Mc Graw Hill Publ. New Delhi.
3. Elements of Farm Machinery. 1989. Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
4. Elements of Agricultural Engineering, Vol. I & III. 1989. Singhal, O.P. Suraj Prakashan, Allahabad.
5. Element of Agricultural Engineering. 1990. Sahay, Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna.

010103006	Production Technology for Vegetables and Spices	2(1+1)
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Course objective-

- To know the physiological growth and development of vegetables and spices.
- To impart knowledge about production technology of vegetables and spices.
- To educate production technology of Leafy vegetable.

Theory

- UNIT-A Importance of vegetables & spices in human nutrition and national economy, kitchen gardening.
- UNIT-B 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.
- UNIT-C Physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas
- UNIT-D Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic, Root crops such as Carrot, Radish, and Beetroot
- UNIT-E Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

Practical

Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation.

Reference Books (Production Technology for Vegetables and Spices):

S. no.	Title of Book	Author	Publisher
1	A Textbook on the production technology of vegetables (2009)	B.R.Choudhary	Kalyani Publishers
2	Vegetable crops in India (2008)	K S Yawalkar	Agri-Horticultural Pub. House. Nagpur
3	Vegetable Crop Production (2007)	K.V.Kamath	Oxford Book Company
4	Olericulture in India (2008)	M.K.Rana	Kalyani Publishers
5	Handbook of Vegetable Crops (2008)	M.S.Dhaliwal	Kalyani Publishers
6	Vegetables for the Tropical Regions (1994)	Nath Prem	ICAR New Delhi
7	Modern Technology in Vegetable Production (2011)	P.Hazra	New India Publishing Agency, New Delhi
8	Major Spices of India- Crop Management Postharvest Technology (1993)	Pruthi, J.S	ICAR
9	Minor Spices of India- Crop Management Postharvest Technology (2001)	Pruthi, J.S	ICAR
10	Text book of vegetable, tuber crops and Spices (2014)	S. Thamburaj	ICAR
11	Production technology of spices and plantation crops (2005)	Shanmugavelu, K.G. Kumar, N and Peter, K. V	Agrosis, Jodhpur
12	Modern Vegetable varieties and production (2007)	Singh, D.K.	IBN publishers, Technology International Book Distributing Co, Lucknow
13	Indian Vegetables (2008)	Singh, Umashankar	Anmol Publications. Pvt.Ltd .New Delhi
14	Vegetable Crops (2002)	T.K.Bose	Nayaprakash, Kolkata
15	Vegetable Crops (2007)	T.R.Gopal Krishnan	New India Publishing Agency. New Delhi
16	Winter Vegetables: Advances & Developments	D.N. Singh etal.	Satish Serial Pub. House
17	Breeding of Vegetable crops	Ramchandra R.K.	Jaya Publishing House
18	Practicals on Vegetable Production Technology	Sharma & Katoch	Jaya Publishing House
19	Diseases of Vegetable crops and their integrated management: A colour handbook	Mishra, R.	NIPA
20	Seeds Production: Vegetables & Root Crops	Boswell, V.R.	ISPG

Course Objective

- To prepares students for careers as leaders in understanding and addressing complex environmental issues.
- To prepare a problem-oriented, interdisciplinary perspective, apply systems concepts and methodologies.
- To analyze and understand interactions between social and environmental processes.

Theory:

UNIT-A 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. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

UNIT-B f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

UNIT-C Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots 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. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.

UNIT-D Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family

Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

UNIT-E Disaster Management - Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

Suggested Readings

1. Bamanayha B.R., Verma, L.N. and Verma A (2005). Fundamentals of Environmental Sciences, Yash Publishing House, Bikaner.
2. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. (2000) Fundamentals of Environmental Sciences, KalyaniPublishers, New Delhi.
3. Odum E.P. and Barrett G.W.(2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Agrawal, K.C.(1999) Environmental Biology, Agro Botanica, Bikaner
5. Kumar, H.D.(1997) Modern concepts of Ecology, Vikash Publishing House Pvt. Ltd. New Delhi.
6. Dhaliwal G.S., and D.S.Kley (2006) Principles of Agricultural Ecology. Himalyan Publishing house, Bombay
7. Brij Gopal, and N.Bhardwaj (2004) Elements of Ecology. Vikash Publishing House, Pvt. Ltd., New Delhi.
8. Kudesta, V.P.(1990). Pollution Everywhere, Pragatgi Prakashan, Meerut
9. Nemeron, R.L.1976. Industrial Water Pollution. Addison Wesley
10. Mishra, P.C.(2001). Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi- 110026.
11. Pathak, H.and Kumar, S.,(2003). Soil and Green House Effect, CBS Publishers and Distributors, 4596/1-A, 11, Dayaganj, New Delhi – 10002.

010103008	Statistical Methods	2(1+1)
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Course Objective

- To know the concepts of statistical methods and statistical inference.
- To understand the concepts of data presentation, analysis and interpretation.
- To understand the calculation of probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Theory

- UNIT-A Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof).
- UNIT-B Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations.
- UNIT-C Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2×2 Contingency Table.
- UNIT-D Introduction to Analysis of Variance, Analysis of One Way Classification.
- UNIT-E 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.

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2×2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

010103009	Livestock and Poultry Management	4(3+1)
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Course Objective

- To impart high quality education to students with an understanding of and ability to apply fundamental principles of livestock production and poultry management
- To develop knowledge of animal husbandry including various livestock species viz. cattle, buffalo, sheep, goat and poultry.
- To apply this knowledge to advance resource efficient and environmentally sound animal and poultry management technologies.

Theory

- UNIT-A Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry.
- UNIT-B Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.
- UNIT-C Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles offered.
- UNIT-D Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.
- UNIT-E Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Suggested Readings:-

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed. ICAR.
2. Choudhary J.L. and Gupta Lokesh. 2016. a Text Book of Animal Husbandry. Somani Publication
3. Devendra C and Mecleroy GB 1982. Goat and Sheep Production in Tropics.
4. Dimri, U, Sharma, M C and Tiwari R. 2013. Swine Production and Health Management. NewIndia Pub Agency.
5. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management. Kalyani
6. Singh, R A. 1996. Poultry Production 3rd Ed Kalyani.
7. Thomas CK and Sastry, NSR. 1991. Dairy Bovine Production. Kalyani.

Semester-IV

Theory Papers			Marks Allocation				
			Theory		Practical			Total	Credit
Subject Code	Subject Name	Type	Internal	External			
010104001	Crop Production Technology – II (Rabicrops)	Core	30	50	15+5	100	3(2+1)
010104002	Production Technology for Ornamental Crops, MAP and Landscaping	Core	30	50	15+5	100	2(1+1)
010104003	Renewable Energy and Green Technology	Core	30	50	15+5	100	2(1+1)
010104004	Problematic soils and their Management	Core	40	50	0+10	100	2(2+0)
010104005	Production Technology for Fruit and Plantation Crops	Core	30	50	15+5	100	2(1+1)
010104006	Principles of Seed Technology	Core	30	50	15+5	100	3(1+2)
010104007	Farming System & Sustainable Agriculture	Core	40	50	0+10	100	1(1+0)
010104008	Agricultural Marketing, Trade & Prices	Core	30	50	15+5	100	3(2+1)
010104009	Introductory Agrometeorology & Climate change	Core	30	50	15+5	100	2(1+1)
Elective (Discipline Centric) Course (anyone)							
0101040010A	Protected Cultivation	Elective (DC)	30	50	15+5	100	3(2+1)
0101040010B	Agribusiness Management	Elective (DC)	30	50	15+5	100	3(2+1)
0101040010C	Agrochemicals	Elective (DC)	30	50	15+5	100	3(2+1)
0101040010D	Commercial Plant Breeding	Elective (DC)	30	50	15+5	100	3(2+1)
0101040011	Educational Tour (Non Gradiual)**	Generic					2 (0+2)**
Total			320	500	180 (120+60)	1000	25

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

****Non Gradiual Course: Satisfactory/Unsatisfactory**

010104001	Crop Production Technology – II (Rabi crops)	3(2+1)
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Course objective

To know the Origin, geographical distribution, economic importance and package of production of Major Rabi crops.

Theory

- UNIT-A Origin, geographical distribution, economic importance, soil and climatic requirements,
 UNIT-B varieties, cultural practices and yield of Rabi crops; cereals –wheat and barley,
 UNIT-C pulses-chickpea, lentil, peas,
 UNIT-D oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane;
 UNIT-E medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

References:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir.2003. Modern Techniques of Raising FieldCrops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. KalyaniPublishers, New Delhi.
3. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
4. Singh, S.S. and Singh, Rajesh. 2013. Crop Management Under Irrigated and RainfedConditions. Kalyani Publishers, New Delhi.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India),Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research,New Delhi.
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi.

010104002	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
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Course objectives-

- To impart comprehensive knowledge about the production technology of ornamental medicinal and aromatic crops and landscaping.

Theory

- UNIT-A Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.
- UNIT-B Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose and chrysanthemum under open conditions.
- UNIT-C Package of practices for loose flowers like marigolds and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, cinnamomum, periwinkle, and isabgol.
- UNIT-D Aromatic plants like mint, lemongrass, citronella, palmarosa, opium, rose, geranium, and vetiver.
- UNIT-E Processing and value addition in ornamental crops and MAPs produce.

Practical

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post-harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Reference Books:

S. no.	Title of Book	Author	Publisher
1	Fundamentals of ornamental horticulture and landscape gardening (2012)	A.K. Tiwari and R. Kumar	New India
2	Introductory Ornamental Horticulture (2006)	Arora, J.S.	Kalyani Publishers
3	Cultivation and Utilization of Medicinal and Aromatic plants (1982)	Atal, E.K. and Kapur, B.	CSIR, New Delhi
4	Cultivation of medicinal and aromatic plants (2001)	Azhar Ali Farooqui and Sreeramu, B.S.	United Press Limited
5	Flowering Garden trees (2014)	Bimaldas Chowdhury and Balai Lal Jana	Pointer publishers, Jaipur
6	Floriculture and Landscaping (2004)	Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P.	Nayaprakash
7	Gardening in India (2004)	Bose, T.K. and Mukherjee, D.	Oxford & IBH Publishers
8	Ornamental Horticulture in India (1986)	Chadha, K.L. and Chaudhary, B.	ICAR
9	Landscape designing and ornamental plants (2014)	H.S.Grewal and Parminder Singh	
10	Ornamental plants (2009)	K.V.Peter.	New India publishing agency
11	Fundamentals of Garden designing (2013)	R.K. Roy	New India publishing agency
12	Fundamentals of Garden designing (2014)	Rajesh Srivastava	Agrotech press, Jaipur
13	Floriculture in India (2004)	Randhawa, G.S. Amitabha Mukhopadhyay	Allied Publishers Pvt. Ltd., New Delhi
14	Fundamentals of Ornamental Horticulture and Landscaping Gardening	Tiwari, A.K.	NIPA
15	Agrotechniques and Uses of Medicinal Plants	Gupta, R.D.	Astral
16	Complete Encyclopedia of House Plants: A comprehensive cross reference guide to popular house plant	Vermeulin, N.	Rebo

Course objectives-

- To learn about various renewable energy sources
- To understand the uses of various biofuels
- To impart knowledge about solar energy and gadgets
- To understand the use of wind energy

Theory

- UNIT-A Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application.
- UNIT-B Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource.
- UNIT-C introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater.
- UNIT-D Application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application.
- UNIT-E Introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

Suggested Readings:

1. G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology.

010104004	Problematic soils and their Management	2(2+0)
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Course objective:

- To know the distribution of problem soils in different agroclimatic zones in India.
- To find out various problems in Saline, sodic, Acidic, Flooded and compact soil.
- Management of various problematic soil
- Quality, standards and utilization of saline water in agriculture.

Theory

UNIT-A Soil quality and health, Distribution of Wasteland and problem soils in India. Their categorization is based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils.

UNIT-B Multipurpose tree species, bioremediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agroecosystems.

Suggested Readings

1. Bear F.E. 1964. Chemistry of the Soil. Oxford & IBH.
2. Jurinak J. J. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. UtahState Univ.
3. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford& IBH.
4. Abrol, I. P. and Dhurva Narayana, V.V. (1998) Technologies for wasteland development,ICAR, New Delhi-110012
5. Cirsan Paul, J. (1985) Principles of remote sensing. Longman, New York.
6. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
7. Somani, L.L. and Totawat, K.L. (1993). Management of salt-affected soils and waters. Agrotech Publishing Academy, Udaipur.
8. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi.
9. ISSS (2015) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi

010104005	Production Technology for Fruit and Plantation Crops	2(1+1)
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Course objectives-

- To enhance massive production of fruit and plantation crops.
- To learn the propagation methods in fruit crops.
- To impart knowledge about production technology of fruit and plantation crops.
- To understand production technology of Plantation crops.

Theory

UNIT-A Importance and scope of fruit and plantation crop industry in India.

UNIT-B Importance of rootstocks.

UNIT-C Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond.

UNIT-D Minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry.

UNIT-E Plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bioregulators and their uses, important pests, diseases, and physiological disorders of above fruit and plantation crops, and visit commercial orchards.

Reference Books (Production Technology for Fruit and Plantation Crops):

S. no.	Title of Book	Author	Publisher
1	Fruit Growing (2010)	Bal, J.S.	Kalyani Publishers
2	Advances in Temperate Fruit Production (2010)	Banday F.A. and Sharma M.K.	Kalyani Publishers
3	Tropical and Sub-Tropical-Vol-I (2002)	Bose, T.K., Mitra, S.K. and Sanyal, D.	Nayaprakash, Kolkata
4	Text Book of Temperate Fruits (2001)	Chadha, T.R	ICAR Publication
5	A text book on Pomology-IV Devoted to Temperate fruits (2009)	Chattopadhyay T.K.	Kalyani Publishers
6	Cultivation of Minor Fruits	Das B.C and Das S.N .	Kalyani Publishers
7	Advanced in Horticulture (2009)	K.L.Chadda	Malhotra Publishing House, New Delhi
8	Introduction to spices, Plantation crops and Aromatic plants (1997)	Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I.	Oxford & IBH, New Delhi
9	Fruit crops (2007)	Radha T and Mathew L.	New India Publishing Agency
10	Commercial fruits (2004)	S.P. Singh	Kalyani Publishers
11	Fruit Production in India (2013)	W S Dhillon	Narendra Publishing House
12	Tropical & Sub-tropical Fruit Crops: Crop Improvement and varietal Wealth- 2 parts	S.N. Ghosh	Jaya Publishing House
13	Temperate Fruit Breeding	Ghosh, Verma Thakur	Jaya Publishing House
14	Breeding of underutilized Fruit crops	S.N. Ghosh	Jaya Publishing House
15	Breeding of Fruit Crops	Ramchandra etal	Jaya Publishing House
16	Fruit Breeding	Dinesh, M.R.	NIPA
17	Upto Date Fruit Science	Bikash Ghosh, Sayan Sau	Jaya Publishing House
18	Fruit tree Physiology	Dhillon/Bhatt	Jaya Publishing House
19	Disease management of Fruit crops	Rathore, G.S.	ATPA

Course objectives:

- To know the maintenance of crop varieties in its pure form.
- To learn the mass production of quality seed.
- To know the seed storage methods.
- To know the seed certification process and its distribution in the market.

Theory

- UNIT-A Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed.
- UNIT-B Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties.
- UNIT-C Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.
- UNIT-D Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.
- UNIT-E Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Reference books:

1. Agarwal, R.L. 1991. Seed Technology, Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology, ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh. 1999. Seed Science and Technology, Kalyani Publishers. New Delhi.
4. Dhirenra Khare and Mohan S. Bhale. 2000. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Maloo, S. R., Intodia, S.K. and Pratap Singh. 2008. Beej Pradyogiki. Agrotech Publishing Academy.
6. A.K. Joshi and B.D. Singh. 2005. Seed Technology. Kalyani Publishers, New Delhi.
7. Arya, P.S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana
8. Saxena, R.P. 1984. Beez Sansadhan, GBPA&T, Pantnagar.
9. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

010104007	Farming System & Sustainable Agriculture	1(1+0)
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Course objective-

- To acquaint the student from agricultural as well as other disciplines with conventional and alternative agricultural practices throughout the world and their effect on long-term sustainability and environmental quality.
- To show how agriculture scientists are using methods to minimize agricultural pollution and sustain food production adequate for the world's population.

Theory

- UNIT-A Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance.
- UNIT-B 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.
- UNIT-C 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.
- UNIT-D 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, resource use efficiency and optimization techniques.
- UNIT-E Resource cycling and flow of energy in different farming systems, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers' field.

References:

1. Panda, S.C.2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Sharma, Arun K. 2002. A Handbook of Organic Farming, Agrobios (India) Ltd., Jodhpur
4. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
5. Shukla, Rajeev K. 2004. Sustainable Agriculture, Surbhee Publications, Jaipur
6. Palaniappan, S.P.1985. Cropping Systems in the Tropics: Principles and Management, Wiley Easter Ltd. and TNAU, Coimbatore.
7. Reddy S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.

010104008	Agricultural Marketing, Trade & Prices	3(2+1)
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Course Objective:

- To impart knowledge of agriculture marketing, different systems, price analysis and trades, and finance policy in Agriculture.
- To providing efficient services in the transfer of farm products and inputs from producers to consumers.
- To provide an efficient marketing system to minimize costs, and benefits all the sections of the society.

Theory

- UNIT-A 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.
- UNIT-B Surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; 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; marketing process and functions:
- UNIT-C Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products;
- UNIT-D Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting the 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;
- UNIT-E Risk in marketing: Types of risk in marketing; speculation & hedging; An overview of futures trading; Agricultural prices and policy: Meaning and functions of price; Administered prices; Need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market

to study various marketing functions performed by different agencies, identification of marketing channels for selected commodities, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

References:

1. Acharya SS & Aggarwal NL. (2011) Agricultural Marketing in India, Oxford and IBH
2. J.R. Moore, S.S. Johl and A.M. Khusro (1973) Indian Food Grain Marketing, Printice Hall.
3. A.S. Kahlon & D.S. Tyagi (1983) Agricultural Price Policyin India, Allied Publishers, New Delhi
4. V.K. Bhall and S. Shiva Ramu (1996) International Business-Environment and Management, Anmol Publications (P) Limited, New Delhi
5. Chandra P. (1984) Projects: Preparation, Appraisal & Implementation, McGraw Hill Inc.
6. Sampat Mukherjee (2002) Modern Economic Theory. New Age International
7. Gupta RD & Lekhi RK. (1982) Elementary Economic Theory, Kalyani Publishers
8. S.S.Acharya & N.L.Agarwal,,: Agricultural prices-Analysis and Policy, Oxford &IBH Publishing Co. PVT. LTD. New Delhi

Course objectives-

- To monitor agricultural droughts on crop-wise for effective drought management.
- To develop weather based agro advisories to sustain crop production.
- To understand various types of weather forecast and seasonal climate forecast.
- To study about Climate change, climatic variability, global warming.

Theory

- UNIT-A Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;
- UNIT-B 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,
- UNIT-C Energy balance of earth; Atmospheric humidity, the concept of saturation, vapour 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.
- UNIT-D Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production.
- UNIT-E 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.

Practical

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. 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. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

References:

1. Sacheti, A. K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.)NCERT Publication, New Delhi.
2. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad.
3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
4. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices, Agrobios (India), Jodhpur.
5. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology, Kalyani Publishers, New-Delhi
6. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
7. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur

010104010A	Protected Cultivation (Elective Course)	3 (2+1)
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Course Objective:

- To get better quality products from Green House.
- To understand water management resources.
- To know surface cover cultivation.
- To get the knowledge of Organic Farming-Vermi Bed
- To know the importance of plastic films, water pond and Reservoir lined.

Theory

UNIT-A Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses.

UNIT-B Green house equipments, Irrigation systems used in greenhouses, typical applications, passive solar greenhouse, hot air green house heating systems.

UNIT-C Plastic Mulching and soil solarization..

UNIT-D Organic Farming and Vermi Bed Preparation.

UNIT-E Water Resource Management and water ponds.

Practical

Raising of seedlings and saplings under protected conditions, use of portrays in quality planting material production, Bed preparation and planting of crop for production, Intercultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging and misting.

Suggested Readings:

1. More, T.A., Jagtap, K.B. and Ranpsie. 1988. Green House Technology, Continental Publishers, Pune.
2. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crop. Kalyani Publishers, Ludhiana.
3. Arora. S.K., Bhatia, A.K., Mangal, J.L. and Kumar, P. 2004. Practical Manual. Green House Technology for Vegetable Production. Dept. of Vegetable Science, CCSHAV, Hisar (Haryana).
4. Anonymous 2003. Proc. All India Seminar on Potential and Prospects for Protective Cultivation. Organised by the Institute of Engineers, Ahmednagar. Dec. 12-13, 2003.
5. Chandra, S. and Som, V. 2000. Cultivating Vegetables in Green House. Indian Horticulture, 15: 17-18.

010104010B	Agribusiness Management (Elective Course)	3 (2+1)
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Course objective-

- To help to take policy decisions in the field of agricultural marketing.
- To understand various appraisal techniques in project with reference to agricultural products, agricultural credit management, financial risk management.
- To orient towards agricultural entrepreneurship.
- To study & analysis of agro-based industries.

Theory

UNIT- A 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.

UNIT-B Institutional arrangement, procedures to set up agro-based industries, Constraints in establishing agro-based industries, Agri-value chain, Understanding primary and support activities and their linkages.

UNIT-C Business environment: PEST & SWOT analysis. Management functions, Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget.

UNIT-D Components of a business plan, steps in planning and implementation. Ordering, leading, supervision, communications, control. Capital Management and Financial Management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies.

UNIT-E Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value-added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

010104010C	Agrochemicals (Elective Course)	3 (2+1)
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Course objective:

- To know about history, concept, importance and scope of agro-chemicals and its effect on environment.
- To provide knowledge of storage, quality control and marketing of these products which are low cost.
- To introduce and classify the insecticide and botanicals and their effect on pest population.

Theory

- UNIT-A An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides- Major classes, properties and important herbicides. Fate of herbicides.
- UNIT-B Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.
- UNIT-C 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 Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea.
- UNIT-D Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility– preparation of major, secondary and micronutrient mixtures.
- UNIT-E Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Murate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

010104010D	Commercial Plant Breeding (Elective Course)	3 (2+1)
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Objectives:

- To get the higher crop yield.
- To improve the quality of crops.
- To develop the resistant varieties.
- To develop the early maturity crop varieties.

Theory

- UNIT-A 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.
- UNIT-B Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.
- UNIT-C 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.
- UNIT-D IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act.
- UNIT-E Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross-pollinated crops.

Practical

Floral biology in self and cross-pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross-pollinated crops using A/B/R and two-line system. Learning techniques in hybrid seed production using male-sterility in field crops. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

Semester-V

Theory Papers			Marks Allocation				
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External			Credit
010105001	Principles of Integrated Pest and Disease Management	Core	30	50	15+5	100	3(2+1)
010105002	Manures, fertilizers and Soil Fertility Management	Core	30	50	15+5	100	3(2+1)
010105003	Pests of Crops and Stored Grains and their Management	Core	30	50	15+5	100	3(2+1)
010105004	Diseases of Field and Horticultural Crops and their Management	Core	30	50	15+5	100	3(2+1)
010105005	Crop Improvement-I (Kharif crops)	Core	30	50	15+5	100	2(1+1)
010105006	Entrepreneurship Development and Business Communication	AECC	30	50	15+5	100	2(1+1)
010105007	Geoinformatics and Nanotechnology and Precision Farming	Core	30	50	15+5	100	2(1+1)
010105008	Practical Crop Production – I (Kharif crops)	Core	0	0	100+0	100	1(0+1)
010105009	Intellectual Property Rights	AECC	40	50	0+10	100	1(1+0)
Elective (Discipline Centric) Course (anyone)							
010105010 A	Agricultural Journalism	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 B	Landscaping	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 C	Food Safety and Standards	Elective (DC)	30	50	15+5	100	3 (2+1)
010105010 D	Biopesticides & Biofertilizers	Elective (DC)	30	50	15+5	100	3 (2+1)
TOTAL			280	450	270 (220+50)	1000	23

Note: To pass, a student is required to obtain a minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

010105001	Principles of Integrated Pest and Disease Management	2(1+1)
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Course objectives

- To acquaint with different strategies for disease and pest management.
- To know the factors for disease development and pest establishment in Field.
- To know about methods for forecasting of Pest attack and disease incidence.

Theory

UNIT-A 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.

UNIT-B Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control:

UNIT-C Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases.

UNIT-D Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease.

UNIT-E Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichoderma, Pseudomonas, Trichogramma, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agroecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmer's fields.

References:

1. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Mehrotra, R.S. and Agrawal, A. 2013. Plant Pathology. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Singh, R.S. 2011. Introduction to Principles of Plant Pathology. 4th ed. Oxford & IBH Publishing Company. New Delhi.
4. Nene Y.L. and Thapliyal, P.N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
5. Dube, H.C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur

010105002	Manures, Fertilizers and Soil Fertility Management	3(2+1)
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Course Objective:

- To understand importance of organic manure, fertilizer and essential plant nutrients in relation to plant growth and crop production.
- Criteria of essentiality of nutrients, available form of nutrients in soil, role, deficiency and toxicity symptoms of essential plant nutrients
- Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.

Theory

UNIT-A Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green manuring. Fertilizer recommendation approaches. Integrated nutrient management.

UNIT-B Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

UNIT-C 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, and factors affecting nutrient availability to plants.

UNIT-D Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation and soil testing.

UNIT-E Critical levels of different nutrients in the soil. 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.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils. Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

References:-

1. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science. Tata McGraw Hill publishing Co. Ltd, New Delhi
2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
3. Rai, M.M. (2002) Principal of Soil Science, Mac Millan India Ltd, New Delhi
4. Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi
5. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi
6. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi
7. Piper, C.S. (1950) Soil and Plant analysis, Hans publications, Bombay
8. Singh Dhyani, Chhonkar, P. K. and Dwivedi V.S. (2005). Manul on Soil Plant andwater analysis. Westville Publishing House, New Delhi
9. Tisdale, S. L. Nelson, W.L. Beaton, J.D. and Havlin, J. L. (1991) Soil fertility and fertilizers (5th ed.). Prentice Hall of India, Pvt. Ltd, New Delhi.
10. Singh Vinay (1996) (Hindi) Soil Science, fertilizer & Manures , V.K. Prakashan Barot Merrut (U.P)
11. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. Agriculture-Horticulture Publishing House, Nagpur.
12. Sanchalli, V.K. (1960). Chemistry and Technology of Fertilizers. Reinhebl publishing corporation, New York, USA.
13. Chopra, S.L. and Kanwar, J.S. (1991). Analytical Agriculture, Chemistry, Kalyani Publishers, New Delhi.
14. Tandon, H.L.S. (1989). Soil water and fertilizers analysis, Fertilizer Development and Consultant organization, New Delhi
15. FAI. (1999). Fertilizer (Control) Order, 1985 and the essential commodities Act, 1995. FAI, New Delhi, pp. 203.
16. Kanwar, J.S. (1976). Soil Fertility: theory and practice. (ed) ICAR, New Delhi pp. 583.
17. McVicker, M.H. (1952). Using commercial fertilizers, Interstate Danvil, US

010105003	Pests of Crops and Stored Grains and Their Management	3(2+1)
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Course Objective-

- To identify the different harmful insect pest of field, horticulture, ornamentals, vegetables and stored grains.
- To know about distribution, host range, biology and nature of damage and assessment of pest population in field.
- To manage harmful insect pests through integrated pest management approach with no side effect on environment, plant and animal health.

Theory

UNIT-A General account of nature and type of damage by different arthropod pests. The scientific name, order, family, host range, distribution, biology and bionomics, nature of the damage, and management of major pests and

UNIT-B 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.

UNIT-C Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.

UNIT-D Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.

UNIT-E Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage. 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. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

Suggested Readings

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
2. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. Nayar, M.R.G.K. 1986. Insects and Mites of Crops in India, ICAR, New Delhi.
5. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I & II, Kalyani Publishers, New Delhi.
6. Reddy, P. Parvatha 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur.

010105004	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)
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Objectives

- To impart knowledge of plant pathogens
- To aware about symptoms of field and horticultural crops.
- To acquaint dispersal of these diseases by means of primary and secondary spread.

Theory

UNIT-A Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose.

UNIT-B Bajra: downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea:

UNIT-C Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

UNIT-D Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and

UNIT-E Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well mounted specimens.

References

1. Cook, A.A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul Y S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R S and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.

Course objectives

- To provide training of breeding methods in the field.
- To create abilities to evaluate resistant varieties with breeding practices on the field.
- To provide field training for observe and classifying the field crop on the basis of phenotypes and genotypes.

Theory

UNIT-A Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops;

UNIT-B Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters;

UNIT-C Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional);

UNIT-D Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc.

UNIT-E Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed descent methods; 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; Visit to seed production plots; Visit to AICRP plots of different field crops.

Reference books:

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, A.K., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol.I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenty First Century (Edt).International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co.. INC, East Port,Connecticut, USA.
6. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

010105006	Entrepreneurship Development and Business Communication	2 (1+1)
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Course Objectives:

- To understand the basic concepts in the area of entrepreneurship.
- To discover the role and importance of entrepreneurship for economic development.
- To understand different skills requires for entrepreneurial development.
- To understand the concept of Supply Chain Management and Total Quality Management for business growth.
- To know the process for project planning and formulation

Theory

- UNIT-A Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & Achievement Motivation,
- UNIT-B Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agri enterprises,
- UNIT-C Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skills (controlling, supervising, problem-solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills),
- UNIT-D Problem solving skills, Supply chain management and Total quality management,
- UNIT-E Project planning Formulation and report preparation; Financing of enterprise, Opportunities for agri entrepreneurship and rural enterprise.

Practical

Assessing entrepreneurial traits, problem-solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

Suggested readings

1. Harold Koontz & Heinz Weihrich. 2004. Essentials of Management: An International Perspective, 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Chole, R. R. Kapse, P. S. and Deshmukh, P. R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
3. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut.
4. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192), Artech House, Inc., USA.
5. Karthikeyan, C. et al. 2008. A Text Book of Agricultural Extension Management. Atlantic Publishers, New Delhi.
6. Natrajan, K. and Ganeshan, K.P. 2012. Principles of Management. Himalaya Publishing House, New Delhi.
7. Bala subramanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.
8. Dipak De & Basavaprabhu Jirli. Entrepreneurship: Theory and practice in agriculture. ISBN 81-85694-57-5, Ganga Kaveri Publishing House, D.35/77, Jangamawadi math, Varanasi-221001 (India), Ph.-0542-2451936
9. Mukesh Pandey & Deepali Tewari. 2010. The Agribusiness Book. IBDC Publishers.
10. Nandan H. 2011. Fundamentals of Entrepreneurship. PHI Learning Pvt Ltd India.
11. Poornima Charanti math. 2006. Entrepreneurship Development: Small Business Enterprise. Pearson Education.
12. Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.

010105007	Geoinformatics and Nanotechnology and Precision Farming	2(1+1)
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Course objective:

- To study about the concepts, techniques, tools and definition of Precision Farming.
- To understand crop discrimination, yield monitoring, soil mapping and fertilizer recommendation using geospatial technologies.
- To study about concepts and techniques of Nanotechnology.

Theory

UNIT-A Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tools and techniques; their use in precision agriculture.

UNIT-B Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies;

UNIT-C Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation;

UNIT-D Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture;

UNIT-E 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.

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

References:

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press
2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGraw Hill Education (India) Pvt. Ltd., New Delhi
3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.
4. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
5. Sekhon, B.S. 2014. Nanotechnology in agri-food production: an overview. Nanotechnology, Science and Applications 7:31-532.

010105008	Practical Crop Production – I (Kharif crops)	1(0+1)
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Course Objective:

- To impart practical oriented knowledge to the students to plan and raise kharif crops of the region.
- To guide students to carry out all the operations required for crop production from field preparation, sowing to harvesting, threshing, drying, winnowing, and packaging of produce for marketing or storage.
- To acquire skill by the students in weed, insect-pest and disease management.

Practical

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.

References:

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy Agrobios (India), Jodhpur.
3. Reddy, S. R., 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

010105009	Intellectual Property Rights	1(1+0)
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Objectives:-

- To acquaint the students with basics of intellectual property rights with special reference to agricultural crop research.
- To encourage and protect innovation in the form of intellectual property rights.
- To provide a superior environment to students for commercialization of intellectual property.
- To encourage research, scholarship, and a spirit of inquiry, there by generating new knowledge.
- To know about role of World Trade Organization in global trade.
- To know about protection of plant varieties under UPOV and PPV&FR Act of India.

Theory

- UNIT-A 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.
- UNIT-B Types of Intellectual Property and legislations covering IPR in India:- Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits,
- UNIT-C Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.
- UNIT-D Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights,
- UNIT-E Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. 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.

Course Objectives:

- To understand the role of communication in personal & professional success.
- To develop awareness of appropriate communication strategies.
- To prepare and present messages with a specific intent.
- To analyze a variety of communication acts.
- To ethically use, document and integrate sources.

Theory

- UNIT-A Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.
- UNIT-B Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.
- UNIT-C The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, and other agricultural news sources.
- UNIT-D Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures.
- UNIT-E Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay-outing.

Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copyreading, headline and title writing, proofreading, lay-outing. Testing copy with a readability formula. Visit to a publishing office.

Suggested Readings:

1. Bhaskaran, C, Prakash, R. & Kishore Kumar, N. 2008. Farm Journalism in Media Management. Agro-Tech. Publishing Academy.
2. Chatterjee, P.C. 1991. Broadcasting in India. Sage Publication.
3. Chiranjeev, A. 1999. Electronic Media Management. Authors Press.
4. D'Souza, Y.K. 1998. Principles and Ethics of Journalism and Mass Communication. Commonwealth Publication.
5. Defleur, M.L. & Dennis, E.E. 2001. Understanding Mass Communications. Goyal saab Publication.
6. Jain, S.C. 2006. International Marketing Management. CBS Publication.
7. Keval, J. Kumar. 2004. Mass Communication in India. Jaico Publication.
8. Malhan, P.N. 2004. Communication Media: Yesterday, Today and Tomorrow. Directorate of Publication Division, New Delhi
9. Mehta, D.S. 1992. Mass Communication and Journalism in India. Allied Publication.
10. Panigrahy, D. 1993. Media Management in India. P.K. Biswas Roy (Ed.). Kanishka Publication.
11. Shrivastava, K.M. 1995. News Writing for Radio and TV. Sterling Publication.

010105010B	Landscaping (Elective Course)	3 (2 + 1)
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Course objectives-

- To impart knowledge about the cultivation aspects of ornamental crops, medicinal, aromatic plants and landscaping.

Theory

UNIT-A Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

UNIT-B Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, other garden plants: palms, ferns, grasses and cacti succulents.

UNIT-C Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas

UNIT-D Peri-urban landscaping, Landscaping of schools, public places like bus stations, railway station, townships, river banks, hospitals, playgrounds, airports, industries, and institutions.

UNIT-E Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/ parks/ institutes.

010105010C	Food Safety and Standards (Elective Course)	3 (2 + 1)
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Objective

- To enhance the health of soil, plants, animals and humans as one and indivisible. Organic farming should be based on the living ecological systems and cycles, work with them, emulate them and help sustain them

Theory

- UNIT-A 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.
- UNIT-B Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control.
- UNIT-C Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.
- UNIT-D Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labelling and Nutritional labelling. Genetically modified foods\ transgenics.
- UNIT-E Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

Water quality analysis physicochemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

010105010D	Biopesticides & Biofertilizers (Elective Course)	3 (2 + 1)
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Course Objective:

- To know about history, concept, importance, and scope of Bio-pesticide and Bio-Fertilizers.
- To provide knowledge of storage, quality control and marketing of these products which are low costing.
- To know the mass production technique of these Bio-control agents and Bio-fertilizers at large scale.

Theory

- UNIT-A 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. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.
- UNIT-B Methods of application of biopesticides. Methods of quality control and Techniques of bio-pesticides. Impediments and limitations in production and use of bio-pesticide. Bio-fertilizers - Introduction, status and scope. Structure and characteristic features of bacterial bio-fertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial.
- UNIT-C Bio-fertilizers- Anabaena, Nostoc, Hapalosiphon and fungal bio-fertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation-Free living and symbiotic nitrogen fixation.
- UNIT-D Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid bio-fertilizers.
- UNIT-E FCO specifications and quality control of bio-fertilizers. Application technology for seeds, seedlings, tubers, sets etc. Bio-fertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of bio-fertilizers.

Practical

Isolation and purification of important biopesticides: Trichoderma Pseudomonas, Bacillus, Metarhizium etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in the nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. Mass multiplication and inoculum production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Semester-VI

Theory Papers			Marks Allocation				
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010106001	Rainfed Agriculture & Watershed Management	Core	30	50	15+5	100	2(1+1)
010106002	Protected Cultivation and Secondary Agriculture	Core	30	50	15+5	100	2(1+1)
010106003	Diseases of Field and Horticultural Crops and their Management	Core	30	50	15+5	100	3(2+1)
010106004	Post-Harvest Management and Value Addition of Fruits and Vegetables	Core	30	50	15+5	100	2(1+1)
010106005	Management of Beneficial Insects	Core	30	50	15+5	100	2(1+1)
010106006	Crop Improvement-II (Rabi crops)	Core	30	50	15+5	100	2 (1+1)
010106007	Practical Crop Production – II (Rabi crops)	Core	0	0	100	100	1(0+1)
010106008	Principles of Organic Farming	Core	30	50	15+5	100	2(1+1)
010106009	Farm Management, Production & Resource Economics	Core	30	50	15+5	100	2(1+1)
010106010	Principles of Food Science & Nutrition	Core	40	50	0+10	100	2(2+0)
Elective (Discipline Centric) Course (any one)							
010106011 A	Weed Management	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011 B	Micro Propagation Technologies	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011 C	Hi-Tech Horticulture	Elective (DC)	30	50	15+5	100	3 (2+1)
010106011 D	System Simulation and Agro-Advisory	Elective (DC)	30	50	15+5	100	3 (2+1)
TOTAL			310	500	290 (235+55)	1100	23

Note: To pass, a student is required to obtain minimum 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Course Objective

- To be acquainted with the meaning, concept and importance of Rainfed Agriculture and watershed management.
- To highlight the problems and prospects of rainfed agriculture in India.
- To study the impact of drought types in crop production.
- To be familiar with climate classification and rainfed pattern in rainfed areas of country.
- To study the different watershed/water harvesting /structures used in rainfed areas.

Theory

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

Practical

Studies on climate classification, studies on rainfall patterns in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping patterns of different rainfed areas in the country and demarcation of rainfed areas on the map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

References:

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
5. Singh, R.P., Sharma, S., Padmnabhan, N.V. , Das, S.K. and Mishra, P.K. 1990. A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.
6. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.
7. Singh, R.P. 1995, Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
8. Singh, S.S., 1993, Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.

010106002	Protected Cultivation and Secondary Agriculture	2(1+1)
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Course Objective:

- To understand Green house its types, design and environment.
- To know the irrigation system, equipments used in green houses.
- To provide knowledge of cost estimation analysis, engineering properties in PHT design and operations.
- To acquaint with drying methods and moisture measurement.
- To inform material handling equipments :conveyer and elevators

Theory

- UNIT-A Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.
- UNIT-B Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar greenhouse, hot air green house heating systems, green house drying.
- UNIT-C Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.
- UNIT-D 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).
- UNIT-E Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different types of green houses based on shape. Determine the rate of air exchange in an active summer-winter cooling system. Determination of drying rate of agricultural products inside green house. Study of greenhouse equipment. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant.

Suggested Readings:

1. Green house: Science and Technology. 2016. Kothari S, S.C. Kaushik and A.N. Mathur. Himanshu Publication, Udaipur.
2. Green House Technology- Application and Practice. Sharma A and V.M. Salokhe. 2006. Agro Tech. publication, Udaipur
3. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha. Jain Brothers, New Delhi.
4. Post Harvest Technology of Cereals, Pulses and Oil Seeds. 1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
5. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willyand Sons, New York.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

010106003	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)
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Objectives

- To impart knowledge of plant pathogens
- To aware about symptoms of field and horticultural crops.
- To acquaint dispersal of these diseases by means of primary and secondary spread.

Theory

UNIT-A Symptoms, etiology, disease cycle and management of following diseases: Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Sunflower: Sclerotinia stem rot and Alternaria blight

UNIT-B Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust. Horticultural Crops:

UNIT-C Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grapevine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry:

UNIT-D Leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt;

UNIT-E Onion and garlic: purple blotch, and Stemphylium blight; Chilies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visits for the diagnosis of field problems. Collection and preservation of plant-diseased specimens for herbarium.

Note: Students should submit 50 pressed and well-mounted specimens.

References

1. Cook, A A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul Y S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R S and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.

010106004	Post-Harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
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Course objective-

- To understanding environment, growth parameter, causes of post-harvest losses, management and value addition.
- To provide employment, often in rural areas.
- To know about the food processing and packaging.

Theory

- UNIT-A Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses;
- UNIT-B Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening;
- UNIT-C Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept;
- UNIT-D Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages.
- UNIT-D Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning -Concepts and Standards, packaging of products

Practical

Applications of different types of packaging, and containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products: physico-chemical and sensory. Visit to processing unit/ industry.

Reference Books (Post-harvest Management and Value Addition of Fruits and Vegetables) :

S. no.	Title of Book	Author	Publisher
1	Post Harvest Technology of Flowers and Ornamentals Plants (2005)	Battacharjee, S. K. and De, L. C	Pointer Publisher
2	A Handbook on Post Harvest management of Fruits and vegetables (2008)	Jacob John, P	Daya Publishing House, Delhi
3	Food Preservation & Processing (1996)	Manoranjan, K and Sangita, S.	Kalyani Publishers
4	Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997)	Mitra, S. K.	CAB International
5	Principles of Fruit Preservation (2006)	Morris, T. N.	Biotech Books, Delhi
6	Post harvest Management of Horticultural Crops (2008)	Saraswathy, S. et. al.	Agribios
7	Fruits and vegetable Preservation – Principles and Practice (2002)	Srivastava, R. P. & Sanjeev Kumar	International Book Distributing Co., Lucknow
8	Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000)	Verma, L. R. and Joshi, V. K.	Indus Publishing Co., New Delhi
9	Text Book of Food Sciences and Technology (2001)	Vijay, K.	ICAR
10	Post Harvest management of Horticultural crops	Mayani, Desai, Vagadia	Jaya Publishing House
11	Good management Practices for Horticultural Crops	Ed. M.K. Jatav, etal.	NIPA
12	Post Harvest management & Processing of fruits & vegetables- Instant notes	Sharma, Satish	NIPA
13	Post Harvest of Horticultural Crops- Practical manual Series Vol.2	Sharma, Satish	NIPA
14	Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability	Rosa L.A.	BioGreen
15	Handling, transportation and Storage of Fruits & Vegetables Vol.1 2 nd Ed (Vegetables & Melons)	Ryall, A.	Sci Int
16	Handling, transportation and Storage of Fruits & Vegetables Vol.2, 2 nd Ed (Fruits & tree nuts)	Ryall, A.	Sci Int
17	Laboratory Manual of Analytical Techniques in Horticulture	Saini, R.	Agro Bot
18	Nutritional Value and Health benefits from fruits, vegetable, nuts & spices	Chavan, U.	Daya
19	Olive: Improvement, Production and Processing	Lal, S.	Astral
20	Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets	Bose, T.	Daya
21	Post Harvest Technology of fruits and Vegetables	Sasikaumar, R.	Biotech

010106005	Management of Beneficial Insects	2(1+1)
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Course Objective-

- To know about the importance, major species and biology of beneficial insects.
- To understand commercial methods of rearing and management of beneficial insects.
- To control the insect pests and diseases of apiculture, sericulture and lac culture and their management.
- To understand about mass production techniques and field release of biological control agents to suppress the pest population.

Theory

UNIT-A Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication.

UNIT-B Insect pests and diseases of the honey bee. Role of pollinators in cross-pollinated plants. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.

UNIT-C Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

UNIT-D Species of lac insect, morphology, biology and host plant, lac production – seed lac, button lac, shellac, lac- products.

UNIT-E Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Suggested Readings

1. DeBach, P. 1974. Biological control by Natural enemies. Cambridge University Press.
2. Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and approaches. Kalyani Publ., New Delhi.
3. Dhaliwal, GS & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
4. Gautam, R.D. Biological Pest Suppression, Westvill Publishing Co., New Delhi.
5. Manfred Mackaur, Laster E.Ehler and Jens Roland. 1990. Critical Issues in Biological control- Intercept Ltd. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. Technical Bulletin -4.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
7. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping, Scientific Publishers, Jodhpur.

010106006	Crop Improvement-II (Rabi crops)	2 (1+1)
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Course objectives

- To provide training of breeding methods on the field.
- To create ability for evaluate resistant varieties with breeding practices in the field.
- To provide field training for observing and classifying the field crop on the basis of phenotype and genotypes.

Theory

- UNIT-A Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops;
- UNIT-B Plant genetic resources, its utilization and conservation;
- UNIT-C Study of the genetics of qualitative and quantitative characters;
- UNIT-D Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional);
- UNIT-E Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for the future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed descent methods; Study of field techniques for seed production and hybrid seeds production in Rabi crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Reference books:

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, A.K., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Connecticut, USA.
6. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

010106007	Practical Crop Production – II (Rabi crops)	1(0+1)
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Course Objective

- To acquaint with the various important field operations carried out in different crops.
- To demonstrate the impact of practical exercises in field crops during crop season.
- To know the systematic approach of cultural practices.
- To know the practical management of Agri - inputs.
- To study the cost of cultivation, net returns, and B/C analysis of different crops.

Practical

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.

References:

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10thedition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
3. Reddy, S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers,Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5thRe-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

010106008	Principles of Organic Farming	2(1+1)
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Objective

- To know the organic farming in relation to enhance the health of soil, plants, animals and humans.
- To know about the certification process of organic farming.

Theory

- UNIT-A** Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture;
- UNIT-B** Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming;
- UNIT-C** Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production;
- UNIT-D** Operational structure of NPOP; Certification process and standards of organic farming;
- UNIT-E** Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

References:

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture (2nd edition), Agrobios (India), Jodhpur.
2. Sharma, Arun K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur
3. Palaniappan, S.P. and Anandurai, K.1999. Organic Farming – Theory and Practice. Scientific Pub. Jodhpur
4. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agritech, Publising Academy, Udaipur.

010106009	Farm Management, Production & Resource Economics	2(1+1)
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Course Objective:

- To determine and outline the conditions that give the optimum use of capital, labour, land and management resources in the production of crops, livestock and allied enterprises.
- To determine the extent to which the existing use of resources deviates from the optimum use.
- To analyze the forces which condition the existing production pattern and resource use.
- To explain the means and methods in getting from the existing use to optimum use of resources.
- To impart the fundamental knowledge and basic concepts of Economics and Farm Management.

Theory:

UNIT-A Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equip-marginal/or principles of opportunity cost and law of comparative advantage.

UNIT-B Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.

UNIT-C Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

UNIT-D 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. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources.

UNIT-E Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

References:

1. Mittal, S.K. and Sethi, C.P. "Linear Programming."
2. Tandan, R.K. and Dhondiyal, S.P. "Principles and Methods of Farm Management".
3. Heady, E.O. and Candler, W. "Linear Programming Methods."
4. Johl, S.S. and Kapoor, T.R. "Fundamental of Farm Business Management, Kalyani Publishers, Ludhiana and New Delhi
5. Sankhayan, P.L "Introduction to the Economics of Agricultural Production."
6. Singh, I.J. "Elements of Farm Management"
7. Dorfman, R. and Samuelson and Solow, R. "Linear Programming and Economic Analysis."
8. Heady, E.O. and Dillors, J.L."Agricultural Production Function".
9. Karam, A.S. and Karan Singh "Economics of Farm Management in India".
10. M.E. Sharpe and Armonk, N.Y.: Environmental and Natural Resource Economics: Theory, Policy and the Sustainable Society
11. Hartieick, J.M. and Olewiler, N.D.: The Economics of Natural Resource Use

010106010	Principles of Food Science & Nutrition	2(2+0)
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Course objective-

- To provide a focus for graduate study and research in food science.
- To understand about the nutritional needs of people in the various life stages. -The life cycle groups are infancy, childhood, adolescence, adulthood, pregnancy, lactation, and elderly.

Theory

UNIT-A Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.);

UNIT-B Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bio actives, important reactions);

UNIT-C Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods);

UNIT-D Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.);

UNIT-E Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

References:-

1. Heldman, Dennis R. "IFT and the Food Science Profession." Food Technology. October 2006. p. 11.
2. Potter, Norman N.; Hotchkiss, Joseph H. (1998). Food Science. Food science texts series (5th ed.). Springer. ISBN 9780834212657.
3. "Food Science Activity Guides". IFT.org. Archived from the original on March 27, 2015. Retrieved February 2, 2015.
4. John M. de Man.1999. Principles of Food Chemistry (Food Science Text Series), Springer Science, Third Edition
5. John M. de Man. 2009. Food process engineering and technology, Academic Press, Elsevier: London and New York, 1st edn.
6. Fratamico PM and Bayles DO (editor). (2005). Foodborne Pathogens: Microbiology and Molecular Biology. Caister Academic Press. ISBN 978-1-904455-00-4.

010106011 A	Weed Management (Elective Course)	3 (2 + 1)
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Course Objectives:

- To define, identify and classify the weeds for their effective management.
- To study common characteristics, beneficial and harmful effects caused by weeds.
- To study herbicides, bio herbicides and allelochemicals for efficient weed management.
- To study weed resistance and its management.
- To assess weed indices, weed control efficiencies and cost of weed management.

Theory

- UNIT-A Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds.
- UNIT-B Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity.
- UNIT-C Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture.
- UNIT-D Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agrochemicals and their application.
- UNIT-E Integration of herbicides with non-chemical methods of weed management. Herbicide Resistance and its management.

Practical

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agrochemicals study. Shift of weed flora study in long-term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Suggested Readings:

1. Gupta, O.P. 2015. Weed Management: Principles and Practices (3rd Edition), Agrobios (India), Jodhpur.
2. Gupta, O.P. 2016. Modern Weed Management (3rd edition), Agrobios (India), Jodhpur.
3. Rao, V.S. 2000. Principles of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.
4. Saraswat, V. N. , Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management, ICAR, New Delhi.

Course Objective:

- To understand the concept of plant tissue culture
- To study the micro propagation
- To study the morphogenesis
- To understand the concept of somatic embryogenesis
- To know the application of *in vitro* techniques

Theory

UNIT-A Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell),

UNIT-B Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture),

UNIT-C Organogenesis (callus and direct organ formation),

UNIT-D Somatic embryogenesis, cell suspension cultures,

UNIT-E Production of secondary metabolites, Somaclonal variation, Cryopreservation

Practical

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

Reference Books

- 1 BD Sing, 2001. Biotechnology Expanding Horizon. Kalyani Publication
- 2 H.S.Chawla, Introduction to plant biotechnology. 2001. Pinnalani for Oxford & IBH publishing Co. Pvt. Ltd. New Delhi.

010106011 C	Hi-Tech Horticulture (Elective Course)	3 (2 + 1)
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Course objective-

- To learn about inception of horticulture and its distinguishing features.
- To Know about the various branches of horticulture,

Theory

UNIT-A Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops, Modern field preparation and planting methods.

UNIT-B Protected cultivation: advantages, controlled conditions, method and techniques,

UNIT-C Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding.

UNIT-D Components of precision farming: Remote sensing, Geographical Information System (GIS).

UNIT-E Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

Types of polyhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

010106011D	System Simulation and Agro-Advisory (Elective Course)	3 (2 + 1)
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Objective

- To learn agricultural droughts on crop-wise for effective drought management practice.
- To evaluate the crop responses to weather elements.
- To develop weather based agro advisories to sustain crop production.
- To study about Weather forecasting- types of weather forecast and their uses.
- To study about Climate change, climatic variability, global warming.

Theory

- UNIT-A System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.
- UNIT-B Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis.
- UNIT-C Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.
- UNIT-D Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity;
- UNIT-E 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.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecasts using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium-range weather forecast. Feedback from farmers about the agro advisory.

References:

1. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad..
2. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
3. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices , Agrobios (India) , Jodhpur.
4. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi

Semester-VII

*Rural Agricultural Work Experience and Agro-industrial Attachment (RAW & AIA)

Theory Papers			Marks Allocation (Tentative)				
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010107001	General Orientation & on-campus training by different faculties	SEC/VOC	0	0	50	50	14
010107002	Village Attachment and Swachh Bharat Abhiyan Activities	SEC/VOC	0	0	400	400	
010107003	Unit attachment in University/College. KVK/Research Station	SEC/VOC	0	0	250	250	
010107004	Plant Clinic	SEC/VOC	0	0	100	100	2
010107005	Agro-Industrial Attachment	SEC/VOC	0	0	150	150	4
010107006	Project Report Preparation, Presentation and Evaluation	SEC/VOC	0	0	50	50	-
TOTAL			0	0	1000	1000	20

Note: To pass, a student is required to obtain a minimum of 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

Semester-VII			
Rural Agricultural Work, Experience and Agro-Industrial Attachment (RAWE & AIA)			
S. No.	Activities	No. of weeks	Credit Hours
1	General Orientation & on-campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./College. KVK/Research Station	5	
3	Plant clinic	2	2
	Agro-Industrial attachment	3	4
4	Project Report Preparation, Presentation and Evaluation	1	
Total Weeks for RAWE & AIA		20	20

- **Agro-Industrial Attachment:** The students would be attached to the agro-industries for 3 weeks to get an experience of the industrial environment and working.
- Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

RAWE Component-I

Village Attachment Training Programme

Sr. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agro-Industrial

Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, post-harvest-value addition, Agri-finance institutions, etc.

Activities and Tasks during the Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on training under the supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business networks including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and tasks performed by the students
- Performance evaluation, appraisal and ranking of students

Semester-VIII

Theory Papers			Marks Allocation				
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External					Credit
010108001	Production Technology for Bioagents and Biofertilizer	SEC/VOC	0	0	100	100	0+10
010108002	Seed Production and Technology	SEC/VOC	0	0	100	100	0+10
010108003	Mushroom Cultivation Technology	SEC/VOC	0	0	100	100	0+10
010108004	Soil, Plant, Water and Seed Testing	SEC/VOC	0	0	100	100	0+10
010108005	Commercial Beekeeping	SEC/VOC	0	0	100	100	0+10
010108006	Poultry Production Technology	SEC/VOC	0	0	100	100	0+10
010108007	Commercial Horticulture	SEC/VOC	0	0	100	100	0+10
010108008	Floriculture and Landscaping	SEC/VOC	0	0	100	100	0+10
010108009	Food Processing	SEC/VOC	0	0	100	100	0+10
010108010	Agriculture Waste Management	SEC/VOC	0	0	100	100	0+10
010108011	Organic Production Technology	SEC/VOC	0	0	100	100	0+10
010108012	Commercial Sericulture	SEC/VOC	0	0	100	100	0+10
010108013	Agri-Business Management	SEC/VOC	0	0	100	100	0+10
010108014	Agro-Advisory Services	SEC/VOC	0	0	100	100	0+10
010108015	Nursery Management	SEC/VOC	0	0	100	100	0+10
TOTAL			0	0	200	200	0+20
<p>Note: Modules for Skill Development and Entrepreneurship: A student shall register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in semester VIII.</p>							
Note :-	(i)	All courses are compulsory total having 183 credits.					

Note: To pass, a student must obtain a minimum of 30% marks in External, Practical/Assignment separately, 40% in individual subjects and 50% marks in semester aggregate.

010108001	Production Technology for Bio-agents and Bio-fertilizers	10 (0+10)
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Practical:

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. Mass production technology of bio-pesticides. Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants. Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques.

References:

1. Shalini Suri, Biofertilizers and Biopesticides, 2011. APH Publishing Corporation.
2. Arun. K. Sharma. 2011. Handbook of Organic farming. Agrobios (India), Jodhpur.
3. S.P. Palaniappan and K. Annadurai. 2010. Organic farming – Theory and Practice. Scientific Publishers. Jodhpur.

010108002	Seed Production & Technology	(0+10,)
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Objectives:-

- To maintain a variety in its pure form.
- To mass production of quality seed.
- To storage of quality seed for long time.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. Seed production in major pulses: Urd, Mung, Cowpea, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard, Groundnut. Seed production in vegetable crops & Seed spices. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plants. Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed.

Reference:

1. Agarwal, R.L.1991.Seed Technology, Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology, ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh.1999. Seed Science and Technology, Kalyani Publishers. New Delhi.
4. Dhirenra Khare and Mohan S. Bhale.2000. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Maloo, S.R., Intodia, S.K. and Pratap Singh.2008. Beej Pradyogiki. Agrotech Publishing Academy.
6. A.K. Joshi and B.D. Singh. 2005. Seed Technology. Kalyani Publishers, New Delhi.
7. Saxena, R.P.1984. Beez Sansadhan, GBPA&T, Pantnagar.
8. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

010108003	Mushroom Cultivation Technology	10 (0+10)
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Objectives

- To disseminate mushroom production technology for economic and nutritional security.
- To generate Income and employment through generation mushroom cultivation.
- To acquire knowledge about edible and non edible mushroom.
- To gain knowledge about nutritional value of mushroom and its value added products.

Practical

Role of mushroom in economic growth, nutritional and medicinal values, Taxonomy of mushroom. Pure culture of fungus, preparation of span production Importance of mushroom cultivation, Cultivation procedure of paddy straw mushroom (outdoor/indoor), concepts, types, uses, food values, Acquaintance with edible, non-edible, medicinal and poisonous mushrooms. Reproduction in Fungi, Fungal growth factors, Nutrition of Mushroom. Cultivation procedure of oyster, Mushrooms, Cultivation procedure milk, Mushroom. Organic mushroom production technology. Demonstration on bag preparation of oyster and milk mushrooms. Opportunities and Constraints. Mushroom processing and preservation (drying/ dehydration, pickling and canning) Value addition in mushroom, preparation of value added products, skill development and marketing activities. Mushroom spawn: quality attributes storage and transport, Acquaintance with mushroom contaminants.

References

1. R.D. Rai and T. Arumuganathan (2008). Post Harvest Technology of Mushrooms, Technical Bulletin-2008, NRCM, ICAR, Chambaghat, Solan-1731213, (H.P.).
2. Sharma B.C. & Sharma V. P. Mushroom cultivation in India
3. Tripathi D P, Mushroom Cultivation Export IDH Publishing Company
4. Shubhratar & R. Mishra Technique of Mushroom Cultivation
5. Rajan S. Mushroom Technology. CBS Publisher and Distributer

010108004	Soil, Plant, Water and Seed Testing	10 (0+10)
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Objective:

- To formalize the students with various materials, machines, processes products and their applications along with relevant aspect of the shop management.
- To make the students understand the psychology of the workers and approach to problems along with practices followed at Field.
- To explain different branches in the field of Agriculture.

Practical

Determination of soil texture by Bouzoukis hydrometer method, capillary rise phenomenon of water in soil column. Laboratory Organization, Laboratory Safety, Quality Control and Standardization Procedures, Data Processing. Concept of seed processing, diversity in seed storage and viability issues, Methods of testing of seed viability. Behavior of seed germination and concept of speed of germination/seed vigor, design of experiments for evaluation of seed related traits. Seed moisture test Germination test – types of germination, Germination test – different methods of germination Seed certification: Procedure. The concentration and composition of dissolved salts in any water determine its quality for irrigation. Mostly the concerns with irrigation water quality relate to possibility of high salt concentration, sodium hazard, carbonate and bicarbonate hazard, or toxic ions (e.g., B or Cl). The analyses required for determining water quality include EC, soluble anions and cations.

References:

1. Maliwal, G. La. and Somani L.L. 2010. Nature Properties and Management of Sineand Alkali Soils. Agrotech Publishing Academy, Udaipur 313 002. pp. 335.
2. Agrawal, P. K., (2010). Principles of Seed Technology. Indian Council of Agricultural Research, New Delhi.
3. Hybrid Seed Production in Field Crops: Principles and Practices by N. C. Singhal, 2003, a. Kalyani publication, Delhi

010108005	Commercial Beekeeping	10 (0+10)
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Importance of beneficial Insects, Honey bee species, castes of bees. Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants. Seasonal management for beekeeping. Adoption of beekeeping as entrepreneur. Important schemes of government to beekeeping.

Reference:

1. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
2. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping, Scientific Publishers, Jodhpur.

010108006	Poultry Production Technology	(0+10)
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Course objective-

- to cover all aspects of modern poultry production including breeding, nutrition, health, behavior, and welfare as well as the quality of meat and eggs.
- To focus on different advancements in the fields of poultry and other animal rearing and animal production with emphasis on environmental and also production management
- To undertake feasibility study and market survey to investigate opportunities in your district or country before establishing a poultry enterprise and to prepare a business plan.
- To discuss with trainees.
- To understand the poultry industry based on the past, present and emphasis of future growth.

Practical

Different types of feathers and function and different type of comb and function (Demo). External body poultry. Respiratory, circulatory digestive and excretory system. Male and female reproductive system. Egg structure and its function. Nervous and endocrine system (Demo). Immune system. Identification method of poultry. Visit to IDF and IPF to study breeds of poultry and daily routine farm operations and farm records. Culling of poultry. Planning and layout of housing for poultry farm. Hatchery operations, incubation and hatching equipment. Management of chicks, growers and layers. Debeaking, dusting and vaccination

Reference:

1. K.K. Dewett and J.D. Verma (1986) Elementary Economic Theory, S. Chand & Company, New Delhi
2. S.K. Mishra and V.K. Puri (1996) Indian Economy, Himalaya Publishing House, New Delhi
3. G.B. Jakhar and S.G. Beri (1996) Elementary Principles of Economics, Oxford University Press (10th Edition), Delhi

010108007	Commercial Horticulture	10(0+10)
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Course objective-

- To learn about inception of horticulture and its distinguishing features.
- To know about the various branches of horticulture.
- To providing employment, often in rural areas.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Reference:

1. Chada, K.L. (2002) Handbook of Horticulture, ICAR, New Delhi.
2. Neeraj Pratap Singh (2005) Basic concepts of Fruit Science, IBDC Publishers
3. Jitendra Singh (2011) Basic Horticulture, Kalyani Publications, New Delhi.

010108008	Floriculture and landscaping	10(0+10)
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Objectives:

- To understand various principles of landscape gardening.
- To learn about different elements used in landscape gardening

Practical

Study of various features of an ornamental garden with suitable plants and identification of plants for each feature, formal gardens (Mughal, Persian, Italian and French gardens) with their different features, special type of gardens (Terrace garden and Rock garden, Commercial Flowers and their packaging, landscaping Highways, Railway stations, Bus terminus and Airports, landscaping factories, places of historic importance, places of worship, landscaping cities, towns, country side, canals and along the bank of rivers, Visit to nearby places of worship, places of historic importance, Airport and highways for study of landscape design

References:

1. Randhawa, G. S. 1973. Ornamental Horticulture in India. Today and Tomorrow's Printers and Publishers, New Delhi.
2. Aora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishres, Ludhiana
3. Bose, T. K and Mukherjee, D. 1977. Gardening in India. Oxford & IBH Publishing Co. Pvt. Ltd., Calcutta.

010108009	Food Processing	10(0+10)
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Course Objectives-

- To impart basic knowledge about food processing.

Practical

Comparison of conventional and microwave processing of food, Preservation of food by the process of freezing, Drying of food using Tray dryer/other dryers, Preservation of food by canning (Fruit/Vegetable/meat), Cut-out analysis of canned food, Osmotic dehydration, Minimal Processing, Testing of Packaging material.

References-

1. Desrosier NW and Desrosier JN, The Technology of Food Preservation, CBS Publication, New Delhi, 1998
2. Paine FA and Paine HY, Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi- 1992
3. Potter NH, Food Science, CBS Publication, New Delhi, 1998
4. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
5. Rao PG, Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, 2010
6. Toledo Romeo T, Fundamentals of Food Process Engineering, Aspen Publishers, 1999.

010108010	Agricultural Waste Management	10 (0+10)
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Course Objective:

- To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.
- To apply ecofriendly methods for agricultural waste management.

Practical

Composting- Solid waste suitable for composting – Methods of composting – vermicomposting - Mineralization process in composting – Biochemistry of composting – Factors involved - Infrastructure required – maturity parameters – value addition – application methods Biomass Briquetting– potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes. Biogas and Bio Ethanol Production, Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids – volatile solids – Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting – nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes – Processing of Biomass to Ethanol -pre-treatment-fermentation-distillation.

References:

1. P.D. Grover and S.K. Mishra, Biomass Briquetting: Technology and Practices. Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.
2. Magdalena Muradin and Zenon Foltynowicz, Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland. Sustainability, 2014, 6, 5065-5074.
3. Biochar production from agricultural wastes via low-temperature microwave carbonization.
4. Qian Kang, Lise Appels, Tianwei Tan and Raf Dewil, Bioethanol from Lignocellulosic Biomass: Current Findings Determine Research Priorities The Scientific World Journal, 2014, Article ID 298153, 13 pages.

010108011	Organic Production Technology	10(0+10)
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Objective

- To know the organic farming in relation to enhance the health of soil, plants, animals and humans.
- To know about the certification process of organic farming.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

References:

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture (2nd edition), Agrobios (India), Jodhpur.
2. Sharma, Arun K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur
3. Palaniappan, S.P. and Anandurai, K. 1999. Organic Farming – Theory and Practice. Scientific Pub. Jodhpur
4. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agritech, Publishing Academy, Udaipur.
5. Singh SP. (Ed.). 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
6. Lampin N. 1990. Organic Farming. Press Books, Ipswich, UK.

010108012	Commercial Sericulture	10(0+10)
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Course Objectives-

- Train the students in identifying the diseases and pests of the mulberry plant.
- It also involves giving students a thorough knowledge about the cultivation of mulberry, maintenance of the farm, seed technology, silkworm rearing and silk reeling.
- Students get to learn about the quality of various things like leaf, seed cocoon, commercial cocoon and fibre so that they can get maximum return when actually practiced.
- To learn about the various skills that are necessary for self-employment in the mulberry and seed production.
- This course gives us employment and job opportunities in the public, private and government sector.

Practical

1. Sericulture maps:
 - a) World maps and Silk Road
 - b) Sericulture map of India and West Bengal
2. Preparation of histograms and pie charts on:-
 - a) Production of Textile fibres in India
 - b) World Silk Production
 - c) Pie chart on mulberry and non-mulberry silk production in India
3. Organization set up in India:- (Demonstration & Exercise)
 - a) Govt. of India, b) Five traditional states viz., Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu & Kashmir
4. Identification and study of Sericulture products: Cotton and Silk Yarn different types, Pupae, Silk Yarn, Noil Yarn
5. Laboratory Note Book, Internal Assessment

References:

1. Charsley, s.r. (1982). culture and sericulture. academic press inc., new york, u.s.a
2. Fao manuals- mulberry cultivation. faorome.
3. Foth, h.d. (1984) fundamentals of soil science. 7th edn., john wiley& sons, new york.
4. Ganga, g., and j. sulochanachetty. (1991) an introduction to sericulture.oxford&ibh publishing company.
5. Hasaoaruga (1994). principles of sericulture (translated from japanese) oxford &ibh publishing co., pvt.ltd. new delhi.
6. Kichisaburo m. (1997) moriculture – science of mulberry cultivation. oxford&ibh
7. Krishnaswami, s.; narasimhanna, m.n.; suryanarayan, s.k and kumararaj, s. (1973) sericulture,manual-2 - silkworm rearing. agriculture service bulletin, fao, rome.

010108013	AGRIBUSINESS MANAGEMENT	10(0 +10)
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Course objective-

- To help to take policy decisions in the field of agricultural marketing.
- To understand various appraisal techniques in project with reference to agricultural products, agricultural credit management, financial risk management.
- To orient towards agricultural entrepreneurship.
- To study & analysis of agro-based industries.

Practical

Study of Agri - input markets. Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Reference:

1. *Agribusiness Management and Trade*. Language: English. Pages: 239. Author: K.B. Vedamurthy.
2. G. L. Meena S. S. Burark D. C. Pant Rajesh Sharma published *Fundamentals of Agribusiness Management*
3. *Agribusiness Management (Routledge Textbooks in Environmental and Agricultural Economics)* 4th Edition by Freddie L. Barnard (Author), Jay T. Akridge (Author), Frank J. Dooley (Author), John C. Foltz (Author), Elizabeth A. Yeager (Author)
4. *Agribusiness and Farm Management at a Glance Vol 1: Objective Fundamentals* 2nd ed by L L & G L Meena Somani
5. *Fundamentals of Agribusiness Finance* by Ralph W. Battles, Robert C. Thompson
6. *Farm Business Management: The Fundamentals of Good Practice (Farm Business Management Series)* by P.L. Nuthall

010108014	Agro-Advisory Services	10(0+10)
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Course Objective:

- To enhance the resilience of Indian agriculture covering crops.
- To demonstrate specific technology packages for farmers .
- To enhance the capacity of students and other stakeholders in climate resilient agricultural research and its applications.
- To study the content of weather based agro meteorological advisory bulletin, its impact and farmers feedback.

Practical:

Overview of integrated Agro-Advisory services in India, variability in weather/climate impacting agriculture. Precipitation events. Needs of farmers - agro-climate & its variability Weather forecast Short & Medium Range Extended range Seasonal Scale Climate Prediction Pest/disease prognosis & control measures Advice on sowing/harvest, cultivar selection, farm input management & intercultural operations. Strategies to empower farmers- Generate information on Weather & Climate (Observations & Forecast) Impact of likely weather on crop Impact of likely weather on P&D Weather based input management Weather sensitivity of farm operations Develop decision making Tools: Data base Crop/Soil/P&D Modeling Remote Sensing & GIS Crop/Soil Monitoring, Drought Monitoring etc. Disseminate information Outreach, capacity building, Feedback. Operational Agro-Meteorology -TIER 1 Apex Policy Planning Body, Delhi Network of 130 Agromet Field Units TIER 2 National Agromet Service HQ Execution, Pune Network of AAS units in the country TIER 3 State Agromet Centres (28) Coordination/Monitoring TIER 4 Agromet Field Units Agroclimatic Zone Level (130) TIER 5 District Level Extension and Training Input Management as advisory~640 Service Goal: Locale & Crop specific Advisory & Farmer Level Outreach.

Reference

1. Chattopadhyay, N. and Chandras, S., Agrometeorological advisory services for sustainable development in Indian agriculture. *Biodiversity International Journal*. 2(1): 13-18 (2018).
2. Dhakar, R., Chandran, M.A.S., Nagar, S. and Kumar, S., Significance of Agrometeorological advisory services in changing climate scenario. *Indian Farming*. 66(8): 44-46 (2016).
3. Khobragade, A.M., Ade, A.U. and Vaseem, A.M.G., Usefulness of Agro Advisory Services (AAS) Regarding Climate Change in Selected Villages of AICRPAMNICRA Project for Marathwada Region. *Journal of Agroecology and Natural Resource Management*. 1(3): 127-129 (2014).
4. Nesheim, I., Barkved, L. and Bharti, N., What Is the Role of Agro-Met Information Services in Farmer Decision-Making? Uptake and Decision-Making Context among Farmers within Three Case Study Villages in Maharashtra, India. *Agriculture*. 7(70): 1-16 (2017).
5. Palkhiwala, K., Agromet Advisory Services - Farmers Empowerment. Press Information Bureau, Government of India. Special Service and Features, May 15, 2012 17: 20 IST (2012).
6. Singh, K.K., Weather forecasting and agromet advisory services in India. India Meteorological Department, Ministry of Earth Sciences, Press released, New Delhi. 22: 240-243 (2015).

010108015	Nursery Management	10(0+10)
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Course objective-

- To understand the propagation method of Horticulture crops
- To impart knowledge about plant growth regulators in propagation.
- To learn about raising nursery.

Practical

Identification of propagation material and equipment. Layout of nurseries and management of progeny orchard. Use of protrays and root trainers in vegetable nursery. Raising and maintenance of root stock. Multiplication of plants by sexual methods. Raising of seedlings. Propagation by cuttings in Horticultural crops. Propagation by budding in Horticultural crops. Propagation by grafting in Horticultural crops. Use of plant growth regulators in propagation. Potting, repotting or lifting of saplings (packaging) for transportation. Use of propagation media. Tetrazolium salt test for determining germination. Visit of commercial nurseries.

Reference Books

1. Bose, T.K. Mitra, SK and Sandhu MK (1986). Propagation of tropical & sub-tropical horticultural crops, Naya Prakash, Calcutta.
2. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay
3. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, New Delhi.

School of Agriculture
B. Sc. (Hons.) Agriculture

Ability Enhancement Compulsory Courses (AECC)

➤	010101005	Comprehension & Communication Skills in English
➤	010101007A/01 0101007B	Introductory Biology*/ Elementary Mathematics*
➤	010103007	Environmental Studies and Disaster Management
➤	010103004	Agricultural Informatics
➤	010105009	Intellectual Property Rights

Core Courses: -

➤	010101001	Fundamentals of Horticulture
➤	010101002	Fundamentals of Plant Biochemistry and Biotechnology
➤	010101003	Fundamentals of Soil Science
➤	010101004	Introduction to Forestry
➤	010101006	Fundamentals of Agronomy
➤	010101008	Agricultural Heritage*
➤	010101009	Rural Sociology & Educational Psychology
➤	010101010	Human values and Ethics (non gradial)
➤	010102001	Fundamentals of Genetics
➤	010102002	Agricultural Microbiology
➤	010102003	Introductory Soil and Water Conservation Engineering
➤	010102004	Fundamentals of Crop Physiology
➤	010102005	Fundamentals of Agricultural Economics
➤	010102006	Fundamentals of Plant Pathology
➤	010102007	Fundamentals of Entomology
➤	010102008	Fundamentals of Agricultural Extension Education
➤	010102009	Communication Skills and Personality Development
➤	010103001	Crop Production Technology – I (Kharif crops)
➤	010103002	Fundamentals of Plant Breeding
➤	010103003	Agricultural Finance and Co-Operation
➤	010103005	Farm Machinery and Power
➤	010103006	Production Technology for Vegetables and Spices
➤	010103008	Statistical Methods
➤	010103009	Livestock and Poultry Management
➤	010104001	Crop Production Technology – II (Rabi crops)

➤	010104002	Production Technology for Ornamental Crops, MAP and Landscaping
➤	010104003	Renewable Energy and Green Technology
➤	010104004	Problematic Soils and their Management
➤	010104005	Production Technology for Fruit and Plantation Crops
➤	010104006	Principles of Seed Technology
➤	010104007	Farming System & Sustainable Agriculture
➤	010104008	Agricultural Marketing, Trade & Prices
➤	010104009	Introductory Agrometeorology & Climate Change
➤	010105001	Principles of Integrated Pest and Disease Management
➤	010105002	Manures, fertilizers and Soil Fertility Management
➤	010105003	Pests of Crops and Stored grains and their management
➤	010105004	Diseases of Field and Horticultural Crops and their Management-I
➤	010105005	Crop Improvement-I (Kharif crops)
➤	010105006	Entrepreneurship Development and Business Communication
➤	010105007	Geoinformatics and Nanotechnology and Precision Farming
➤	010105008	Practical Crop Production – I (Kharif crops)
➤	010106001	Rainfed Agriculture & Watershed Management
➤	010106002	Protected Cultivation and Secondary Agriculture
➤	010106003	Diseases of Field and Horticultural Crops and their Management-II
➤	010106004	Post-Harvest Management and Value Addition of Fruits and Vegetables
➤	010106005	Management of Beneficial Insects
➤	010106006	Crop Improvement-II (Rabi crops)
➤	010106007	Practical Crop Production – II (Rabi crops)
➤	010106008	Principles of Organic Farming
➤	010106009	Farm Management, Production & Resource Economics
➤	010106010	Principles of Food Science & Nutrition

Electives (Discipline Centric) Courses: -

➤	010104010A	Protected Cultivation
➤	010104010B	Agribusiness Management
➤	010104010C	Agrochemicals
➤	010104010D	Commercial Plant Breeding
➤	010105010A	Agricultural Journalism
➤	010105010B	Landscaping
➤	010105010C	Food Safety and Standards
➤	010105010D	Biopesticides & Biofertilizers
➤	010106011A	Weed Management
➤	010106011B	Micro Propagation Technologies
➤	010106011C	Hi-Tech Horticulture
➤	010106011D	System Simulation and Agro-Advisory

Generic / Open Electives Courses: -

➤	010101011	NSS/NCC/Physical Education & Yoga Practices
	010105010	Agricultural Journalism

***Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE &AIA)**

➤	010107001	General Orientation & on-campus training by different faculties
➤	010107002	Village Attachment and Swachh Bharat Abhiyan Activities
➤	010107003	Unit attachment in University/College. KVK/Research Station
➤	010107004	Plant Clinic
➤	010107005	Agro-Industrial Attachment
➤	010107006	Project Report Preparation, Presentation and Evaluation

Skill Enhancement Courses (SEC)/ Vocational Courses (VOC):-

➤	010108001	Production Technology for Bioagents and Biofertilizer
➤	010108002	Seed Production and Technology
➤	010108003	Mushroom Cultivation Technology
➤	010108004	Soil, Plant, Water and Seed Testing
➤	010108005	Commercial Beekeeping
➤	010108006	Poultry Production Technology
➤	010108007	Commercial Horticulture
➤	010108008	Floriculture and Landscaping
➤	010108009	Food Processing
➤	010108010	Agriculture Waste Management
➤	010108011	Organic Production Technology
➤	010108012	Commercial Sericulture
➤	010108013	Agri-Business Management
➤	010108014	Agro-Advisory Services
➤	010108015	Nursery Management

ASSESSMENT AND OUTCOME MEASUREMENT METHODS (AOMM)

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this programme, the following assessment methods shall be adopted:

- i. Scheduled/unscheduled tests
- ii. Problem solving sessions aligned with classroom lectures
- iii. Practical assignments
- iv. Regular chamber consultation with faculty members
- v. Mid semester examination and semester end comprehensive examination

Examination and Evaluation:

- i. The medium of instructions and examination shall be English.
- ii. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.
- iii. To pass each semester examination, a candidate must obtain at least 40% marks in each written paper, practical work semester examination.
- iv. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.
- v. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 70 (Seventy) marks in theory Papers and Internal Evaluation of 30 (Thirty) marks.

The criterion for awarding Grading System:

Criterion for Awarding SGPA and CGPA: The criterion for awarding the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) for B.Sc. (Hons) Agriculture programme shall be as follows:

- a) The criterion for passing in a subject is that a student should secure minimum 40% marks in individual paper.
- b) A student obtaining less than pass marks as specified above, in each subject (sum of internal and End-Term examinations) he will be declared fail in that subject and will have to re-appear in a End-Term examination of the course in subsequent odd / even semester end term examination, subject to maximum permissible period of n+4 semesters to complete the course.

- c) The University has adopted Absolute Grading System for converting marks into grades. The formula of 10- point grading system for conversion of marks obtained into Letter Grades and converting Letter Grades to Grade Point is given below:

Table: Marks, Letter Grades and Grade Points

Marks	Letter Grade	Grade Points
91-100	O (Outstanding)	10
81-90	A+(Excellent)	9
71-80	A(Very Good)	8
61-70	B+(Good)	7
51-60	B(Above Average)	6
46-50	C(Average)	5
40-45	P (Pass)*	4
0-39	F(Fail)	0
-	AB (Absent)	0

***Pass Mark: 40% in individual paper**

- d) While converting the marks into Letter Grade, the rounding off marks must be considered.
- e) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.
- f) For noncredit courses "Satisfactory" or Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Computation of SGPA and CGPA:

The university has adopted UGC recommended procedure for computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

- a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the papers/ courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\text{SGPA (Si)} = \Sigma (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course. The university shall issue Semester Grade Card to the student.

- b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\text{CGPA} = \Sigma (Ci \times Si) / \Sigma Ci$$

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

- c) The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

- a) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course/Paper 1	2	A	8	2x8=16
Course/Paper 2	3	B+	7	3x7=21
Course/Paper 3	3	B	6	3x6=18
Course/Paper 4	2	O	10	2x10=20
Course/Paper 5	2	C	5	2x5=10
Course/Paper 6	4	B	6	4x6=24
Course/Paper 7	2	A	8	2x8=16
Course/Paper 8	2	B	6	2x6=12
	20			137

Thus, SGPA= 137/20= 6.85

Illustration for CGPA

Semester-1	Semester-2	Semester-3	Semester-4	Semester-5	Semester-6	Semester-7	Semester-8
Credit: 20	Credit: 24	Credit: 24	Credit: 23	Credit: 24	Credit: 24	Credit: 20	Credit: 20
SGPA:6 .8	SGPA:7 .8	SGPA:5 .6	SGPA:6 .0	SGPA:6 .3	SGPA:8 .0	SGPA:8 .0	SGPA:8 .0

Thus, CGPA= 20x6.8+24x7.8+24x5.6+23x6.0+24x6.3+24x8.0+20x8.0+20x8.0

----- = 7.03

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TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.
3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TOT).

KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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