Faculty of Science

Syllabus

For

B.Sc. (Hons.) Agriculture

(Program Code: SC0141)

(2023-24)

INDEX

1. INTRODUCTION

This curriculum framework for the bachelor-level program in Agriculture is developed keeping in view of the student centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven.

To avoid rote -learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework focuses on pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works. The platform aims at equipping the graduates with necessary skills for Agriculture related careers, careers with general graduate-level aptitude and for higher education in Agriculture and allied subjects. Augmented in this framework are graduate attributes including critical thinking, basic psychology, scientific reasoning, moral ethical reasoning and so on, qualification descriptors that are specific outcomes pertinent to the discipline of Agriculture, learning outcomes for the two programmes these frameworks have been developed, learning outcomes for individual courses, pedagogical methods and assessment methods. While designing these frameworks, emphasis is given on the objectively measurable teaching-learning outcomes to ensure employability of the graduates. In line with recent trends in education section, these frameworks foster implementation of modern pedagogical tools and concepts such as flip-class, hybrid learning, MOOCs and other e-learning platforms. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of higher education in B.Sc. (Hons.) Agriculture may be achieved using the following measures:

i. Curriculum reform based on learning outcome-based curriculum framework (LOCF).
ii. To transform curriculum into outcome-oriented scenario
iii. To develop the curriculum for fostering discovery-learning
iv. To equip the students in solving the practical problems.
v. To adopt recent pedagogical trends in education including e-learning, flipped class, hybrid learning and MOOCs
vi. Improving learning environment and academic resources.

2. LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING

The learning outcome based curriculum is very specific in nature in terms of changes in the cognitive, affective and psychomotor behavior of the students as a result of their exposure to the curriculum.

The Bachelor's Degree in Agriculture sciences B.Sc. (Hons.) is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this programme are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The LOCF have designed courses of B.Sc. in the light of graduate attributes, description of qualifications, courses and programme learning outcomes. It may lead to all round development

and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this programme.

The programme has been planned in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.
ii. Learning outcomes of courses.
iii. Teaching-learning methodology
iv. Addition of new elective courses subject to chice of students and availability of experts in colleges/institutes/universities across the country.
v. Assessment technique of students and knowledge levels.

2.1. Nature and Extent of Bachelor's Degree Programme

As a part of effort to enhance employability of B.Sc. (Hons.) Agriculture graduates expected learning outcomes are very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree programme must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of Bachelor's Degree programme B.Sc. (Hons.) Agriculture

The overall aims of B.Sc. Agriculture Science are

i. To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects
ii. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. Agriculture graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
iii. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
iv. To encourage personal growth among students and boost their self confidence which will give them opportunities to be an integral part of agro industry or startup.
v. Use knowledge understanding and skills for critical assessment of wide range of ideas and problems in the field of Agriculture.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

i. Framing of syllabi
ii. Learners attributes
iii. Qualification descriptors
iv. Programme learning outcomes
v. Course learning outcomes
vi. Necessity of having elective courses
vii. Academic standards

3. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Imparting subject-related knowledge along with developing a connection between practical solutions and theory

PEO 2 Exhibit their skill in providing solution in agriculture sectors like Gardening, seed Production , Fruit ,Spices and vegetable Cultivation ,Milk Production , Crop Production and Mushroom Cultivation

PEO 3 To develop scientific, economic and environmental principles underpinning agricultural production and land use among the students.

4. GRADUATE ATTRIBUTES (GAs)

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

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of B.Sc. programme and understanding of one or more disciplines which form a part of an undergraduate programme of study.

GA2: Critical Thinking: Ability to employ critical thinking in understanding the concepts in every area of B.Sc. programme.

GA3: Analytical Reasoning: Ability to analyze the results and apply them in various problems appearing in different courses.

GA4: 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.

GA5: 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.

GA6: Usage of Modern Tools (Information/digital literacy):

Create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA7: Self-directed learning: Ability to work independently and do in-depth study of various notions of courses of B.Sc. Programme.

GA8: Communication skills:

i. Ability to communicate various concepts of 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 precursor to various scientific developments since the beginning of the civilization.

GA9. 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.

GA10: Team work and Lifelong learning:

Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

GA11: 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.

GA12. 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 in a smooth and efficient way.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptors for a Bachelor's degree in Agriculture (Hons.) may include following:

i. To demonstrate a systematic, extensive and coherent knowledge and understanding of academic fields of study as a whole and its applications and links to disciplinary areas of the study; including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of Agriculture;
ii. To demonstrate procedural knowledge that creates different types of professionals in the field of Agriculture like in research and development, teaching government and public services e.g. conservationist, plant explorer, ecologist, horticulturist, plant biochemist, plant breeder, agronomist, soil scientist, entomologist, nursery manager, molecular biologist, plant pathologist, taxonomist, farming consultant and environmental consultant. Further application

of knowledge can enhance productivity of several economically important product/botanicals. Knowledge of Agriculture is also necessary for the development and management of problematic soils, forests, parks, wastelands and sea wealth.

iii. Developing skills and ability to use knowledge efficiently in areas related to specializations and current updates in the subject.

iv. Demonstrate comprehensive knowledge about plants, current research, scholarly and professional literature of advanced learning areas of Agriculture.

v. Use knowledge understanding and skills for critical assessment of wide range of ideas and problems in the field of Agriculture.

vi. Communicate the results of studies in the academic field of Agriculture using main concepts, constructs and techniques.

vii. Apply one's knowledge and understanding ofAgriculture to new/unfamiliar contexts and to identify problems and solutions in daily life.

6. 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 scrop production system of field & horticultural crops, plant protection against insect pests, 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 solves the agriculture problems.

PO4: Research and project management: Demonstrate knowledge and understand agricultural research and apply these to one's own 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 and with 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 modeling 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 socio-technological changes.

PO8: Communication skill: Generate effectively objectives as a member or leader in diverse teams and in multidisciplinary settings for overall development of 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: Team work 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 system 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 a farming activities, start up and agri- business management or agriculture business.

Mapping of Graduate Attributes (GAs) and Programme Learning Outcomes (POs):

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: To Understand the impact of the professional agricultural solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO 2: Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand mechanics of agripreneurship.

Bloom Taxonomy Levels:

Level of Taxonomy	Definition	Action Verbs	
Creating L6	Generating new ideas, products, or ways of viewing things Designing, constructing, planning, producing, inventing	Act Arrange Assemble Combine Compose Construct Create Design Develop Devise Formulate	Generate Improve Infer Invent Imagine Plan Predict Prepare Revise Show Write
Evaluating L5	Justifying a decision or course of action Checking, hypothesizing, critiquing, experimenting, judging	Argue Assess Choose Compare Conclude Criticize Debate Decide Defend	Determine Evaluate Justify Prioritize Rate Recommend Support Tell why Value

Analyzing L4	Breaking information into parts to explore understandings and relationships Comparing, organizing, deconstructing, interrogating, finding	Calculate Categorize Classify Compare Contrast Diagram Differentiate Discover Distinguish Examine Experiment	Group Interpret Investigate Order Organize Question Relate Research Sequence Solve Survey
Applying L3	Using information in another familiar situation Implementing, carrying out, using, executing	Adapt Apply Calculate Change Compute Demonstrate Dramatize Draw Experiment Illustrate	List Make Manipulate Practice Produce Sequence Show Solve Teach Use
Understanding L2	Explaining ideas or concepts Interpreting, summarizing, paraphrasing, classifying, explaining	Ask Calculate Convert Describe Discuss Explain Give examples Identify Locate	Observe Recognize Report Research Retell Review Summarize Tell

Remembering L1	Recalling information Recognizing, listing, describing, retrieving, naming, finding	Choose Cite Define Describe Give example Group Know Label List Listen Locate	Match Memorize Name Quote Recall Recite Record Repeat Select Underline

Bloom taxonomy levels:

Level of taxonomy	Blooms level
Knowledge	L1
Understanding	L2
Applying	L3
Analyzing	L4
Evaluating	L5
Creating	L6

Mapping between PO and Blooms level:

POs	Action verb(s) in POs	Blooms level(s) for Pos
PO1	Know	L1
	Solve	L3
	Discuss	L2
PO2	Solve	L3
	Survey	L4
PO3	Calculate	L2
	Analyze	L4
	Apply	L3
PO4	Apply	L3
	Demonstrate	L3
	Research	L4
	Knowledge	L1
PO5	Solve	L3, L4
	Formulate	L6

	Review	L2
PO6	Create	L6
	Select	L1,L5
PO7	Determine	L5
PO8	Generate	L6
	Design	L3, L6
	Group	L1, L4
PO9	Interpret	L2, L3, L4
PO10	Recognize	L2
PO11	Report	L2
	Value	L5
	Interpret	L4
PO12	Plan	L6
	Implement	L3

Types of Courses

Courses in a programme may be of four kinds: Core, Elective, Ability Enhancement and Skill Enhancement.

a) Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the programme in a said discipline of study.

b) Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

(i) ***Discipline Centric/Specific Elective (DSE):*** Elective courses offered under the main discipline/subject of study is referred to as Discipline Centric/Specific.

(ii) ***Generic/Open Elective (GE):*** An elective course chosen from an unrelated discipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

c) Ability Enhancement Compulsory Courses (AECC):-

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC):-

SEC Courses provide value based and/or skill based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability.

B.Sc.(Hons.) Agriculture

List of Courses B. Sc. (Hons.) Agriculture

(a) Core Courses :-

➢	AG 101	Fundamentals of Horticulture
➢	AG 102	Fundamentals of Plant Biochemistry and Biotechnology
➢	AG 103	Fundamentals of Soil Science
➢	AG 104	Introduction to Forestry
➢	AG 106	Fundamentals of Agronomy
➢	AG 108	Agricultural Heritage*
➢	AG 109	Rural Sociology & Educational Psychology
➢	AG 110	Human values and Ethics (non gradial)
➢	AG 201	Fundamentals of Genetics
➢	AG 202	Agricultural Microbiology
➢	AG 203	Introductory Soil and Water Conservation Engineering
➢	AG 204	Fundamentals of Crop Physiology
➢	AG 205	Fundamentals of Agricultural Economics
➢	AG 206	Fundamentals of Plant Pathology
➢	AG 207	Fundamentals of Entomology
➢	AG 208	Fundamentals of Agricultural Extension Education
➢	AG 209	Communication Skills and Personality Development
➢	AG 301	Crop Production Technology – I (*Kharif* crops)
➢	AG 302	Fundamentals of Plant Breeding
➢	AG 303	Agricultural Finance and Co-Operation
➢	AG 305	Farm Machinery and Power
➢	AG 306	Production Technology for Vegetables and Spices
➢	AG 308	Statistical Methods
➢	AG 309	Livestock and Poultry Management
➢	AG 401	Crop Production Technology – II (*Rabi* crops)
➢	AG 402	Production Technology for Ornamental Crops, MAP and Landscaping
➢	AG 403	Renewable Energy and Green Technology
➢	AG 404	Problematic soils and their Management
➢	AG 405	Production Technology for Fruit and Plantation Crops
➢	AG 406	Principles of Seed Technology
➢	AG 407	Farming System & Sustainable Agriculture
➢	AG 408	Agricultural Marketing, Trade & Prices

➢	AG 409	Introductory Agrometeorology & Climate change
➢	AG 501	Principles of Integrated Pest and Disease Management
➢	AG 502	Manures, fertilizers and Soil Fertility Management
➢	AG 503	Pests of Crops and Stored grains and their Management
➢	AG 504	Diseases of Field and Horticultural Crops and their Management-I
➢	AG 505	Crop Improvement-I (*Kharif* crops)
➢	AG 506	Entrepreneurship Development and Business Communication
➢	AG 507	Geoinformatics and Nanotechnology and Precision Farming
➢	AG 508	Practical Crop Production – I (*Kharif* crops)
➢	AG 601	Rainfed Agriculture & Watershed Management
➢	AG 602	Protected Cultivation and Secondary Agriculture
➢	AG 603	Diseases of Field and Horticultural Crops and their Management-II
➢	AG 604	Post-Harvest Management and Value Addition of Fruits and Vegetables
➢	AG 605	Management of Beneficial Insects
➢	AG 606	Crop Improvement-II *(Rabi crops)*
➢	AG 607	Practical Crop Production – II (Rabi crops)
➢	AG 608	Principles of Organic Farming
➢	AG 609	Farm Management, Production & Resource Economics
➢	AG 610	Principles of Food Science & Nutrition

(b) Electives (Discipline Centric) Courses :-

➢	AG 410A	Protected Cultivation
➢	AG 410B	Agribusiness Management
➢	AG 410C	Agrochemicals
➢	AG 410D	Commercial Plant Breeding
➢	AG 510B	Landscaping
➢	AG 510C	Food Safety and Standards
➢	AG 510D	Biopesticides & Biofertilizers
➢	AG 611A	Weed Management
➢	AG 611B	Micro Propagation Technologies
➢	AG 611C	Hi-Tech Horticulture
➢	AG 611D	System Simulation and Agro-Advisory

Generic / Open Electives Courses :-

➢	AG 111	NSS/NCC/Physical Education & Yoga Practices
➢	AG 510A	Agricultural Journalism

(c) Ability Enhancement Compulsary Courses (AECC)

➢	AG 105	Comprehension & Communication Skills in English
➢	AG 107A/AG 107B	Introductory Biology*/ Elementary Mathematics*
➢	AG 307	Environmental Studies and Disaster Management
➢	AG 304	Agricultural Informatics
➢	AG 509	Intellectual Property Rights

(d) Skill Enhancement Courses (SEC):-

➢	AG 701	General Orientation &on campus training by different faculties
➢	AG 702	Village attachment and Swachh Bharat Abhiyan Activities
➢	AG 703	Unit attachment in University/College. KVK/Research Station
➢	AG 704	Plant Clinic
➢	AG 705	Agro-Industrial Attachment
➢	AG 706	Project Report Preparation, Presentation and Evaluation
➢	AG 801	Production Technology for Bioagents and Biofertilizer
➢	AG 802	Seed Production and Technology
➢	AG 803	Mushroom Cultivation Technology
➢	AG 804	Soil, Plant, Water and Seed Testing
➢	AG 805	Commercial Beekeeping
➢	AG 806	Poultry Production Technology
➢	AG 807	Commercial Horticulture
➢	AG 808	Floriculture and Landscaping
➢	AG 809	Food Processing
➢	AG 810	Agriculture Waste Management
➢	AG 811	Organic Production Technology
➢	AG 812	Commercial Sericulture
➢	AG 813	Agri Business Management
➢	AG 814	Agro-Advisory Services
➢	AG 815	Nursery Management

8. COURSE-WISE LEARNING OBJECTIVES, STRUCTURES AND OUTCOMES (CLOSOs)

Course learning outcomes of each course in B.Sc.(Hons) Agriculture as a subject have been enshrined in the end of course contents of each course with their objectives those are in the beginning of the every course.

Semester-I

Theory Papers			Marks Allocation				
			Theory		Practical/ Assignment	Total	Credit
Subject Code	Subject Name	Type	Internal	External			
AG 101	Fundamentals of Horticulture	Core	30	50	15+5	100	2(1+1)
AG 102	Fundamentals of Plant Biochemistry and Biotechnology	Core	30	50	15+5	100	3(2+1)
AG 103	Fundamentals of Soil Science	Core	30	50	15+5	100	3(2+1)
AG 104	Introduction to Forestry	Core	30	50	15+5	100	2(1+1)
AG 105	Comprehension & Communication Skills in English	AECC	30	50	15+5	100	2(1+1)
AG 106	Fundamentals of Agronomy	Core	30	50	15+5	100	4(3+1)
AG 107A	Introductory Biology*	AECC	30	50	15+5	100	2(1+1)*
AG 107B	Elementary Mathematics*	AECC	40	50	0+10	100	2(2+0) *
AG 108	Agricultural Heritage	Core	40	50	0+10	100	1(1+0)
AG 109	Rural Sociology & Educational Psychology	Core	40	50	0+10	100	2(2+0)
AG 110	Human values and Ethics **(Non Gradial)****	Core	…	…	…	Satisfactory	1(1+0)**
AG 111	NSS/NCC/Physical Education & Yoga Practices**(Non Gradial)****	Generic	…	…	…	Satisfactory	2(0+2)**
TOTAL			**290/ 300**	**450**	**160/150**	**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/NON-SATISFACTORY.

****Non Gradial Course: Satisfactory/Non Satisfactory**
***R : Remedial Course**

Note:

1. 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.
2. The following courses are identified for fullfilment of UGC quality mandate from academic session 2020-2021.

Sl. No.	UGC quality mandate (New course)	Identified semester	Course adjusted in existing
1	Communication Skill	I	I - AG 105
2	Professional Skill	V	V – AG 506
3	Leadership and Management Skill	VII	V – AG 506
4	University Human Values	II	II – AG 110

AG – 105: Comprehension & Communication Skills in English

AG – 110: Human values and Ethics

AG - 506: Entrepreneurship Development and Business Communication

The above four courses may adjust in two semester i.e. I and V

Thus these courses has fulfill the requirement of both UGC and ICAR

The VII senester is marked for RAWE

Semester-II

Theory Papers			Marks Allocation				
			Theory		Practical/ Assignment	Total	Credit
Subject Code	Subject Name	Type	Internal	External			
AG 201	Fundamentals of Genetics	Core	30	50	15+5	100	3(2+1)
AG 202	Agricultural Microbiology	Core	30	50	15+5	100	2(1+1)
AG 203	Introductory Soil and Water Conservation Engineering	Core	30	50	15+5	100	2(1+1)
AG 204	Fundamentals of Crop Physiology	Core	30	50	15+5	100	2(1+1)
AG 205	Fundamentals of Agricultural Economics	Core	40	50	0+10	100	2(2+0)
AG 206	Fundamentals of Plant Pathology	Core	30	50	15+5	100	4(3+1)
AG 207	Fundamentals of Entomology	Core	30	50	15+5	100	4(3+1)
AG 208	Fundamentals of Agricultural Extension Education	Core	30	50	15+5	100	3(2+1)
AG 209	Communication Skills and Personality Development	Core	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.

Semester-III

Theory Papers			Marks Allocation				Credit
			Theory		Practical/ Assignment	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 301	Crop Production Technology – I (*Kharif* crops)	Core	30	50	15+5	100	3(2+1)
AG 302	Fundamentals of Plant Breeding	Core	30	50	15+5	100	3(2+1)
AG 303	Agricultural Finance and Co-Operation	Core	30	50	15+5	100	3(2+1)
AG 304	Agricultural Informatics	AECC	30	50	15+5	100	2(1+1)
AG 305	Farm Machinery and Power	Core	30	50	15+5	100	2(1+1)
AG 306	Production Technology for Vegetables and Spices	Core	30	50	15+5	100	2(1+1)
AG 307	Environmental Studies and Disaster Management	AECC	30	50	15+5	100	3(2+1)
AG 308	Statistical Methods	Core	30	50	15+5	100	2(1+1)
AG 309	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 minimum 30% marks in External, Practical/Assignment separately,
40% in individual subject and 50% marks in semester aggregate.

Semester-IV

Theory Papers			Marks Allocation				Credit
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 401	Crop Production Technology – II (*Rabi* crops)	Core	30	50	15+5	100	3(2+1)
AG 402	Production Technology for Ornamental Crops, MAP and Landscaping	Core	30	50	15+5	100	2(1+1)
AG 403	Renewable Energy and Green Technology	Core	30	50	15+5	100	2(1+1)
AG 404	Problematic soils and their Management	Core	40	50	0+10	100	2(2+0)
AG 405	Production Technology for Fruit and Plantation Crops	Core	30	50	15+5	100	2(1+1)
AG 406	Principles of Seed Technology	Core	30	50	15+5	100	3(1+2)
AG 407	Farming System & Sustainable Agriculture	Core	40	50	0+10	100	1(1+0)
AG 408	Agricultural Marketing, Trade & Prices	Core	30	50	15+5	100	3(2+1)
AG 409	Introductory Agrometeorology & Climate change	Core	30	50	15+5	100	2(1+1)
	Elective Course						
AG 410A	Protected Cultivation	Elective	30	50	15+5	100	3(2+1)
AG 411	Educational Tour **(Non Gradial)****						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 subject and 50% marks in semester aggregate.
****Non Gradial Course : Satisfactory / Non Satisfactory**

Elective Course (any one)	
Sub. Code	**Subject Name**
AG 410A	Protected Cultivation
AG 410B	Agribusiness Management
AG 410C	Agrochemicals
AG 410D	Commercial Plant Breeding

Semester-V

Theory Papers			Marks Allocation				Credit
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 501	Principles of Integrated Pest and Disease Management	Core	30	50	15+5	100	3(2+1)
AG 502	Manures, fertilizers and Soil Fertility Management	Core	30	50	15+5	100	3(2+1)
AG 503	Pests of Crops and Stored Grains and their Management	Core	30	50	15+5	100	3(2+1)
AG 504	Diseases of Field and Horticultural Crops and their Management-I	Core	30	50	15+5	100	3(2+1)
AG 505	Crop Improvement-I (*Kharif* crops)	Core	30	50	15+5	100	2(1+1)
AG 506	Entrepreneurship Development and Business Communication	Core	30	50	15+5	100	2(1+1)
AG 507	Geoinformatics and Nanotechnology and Precision Farming	Core	30	50	15+5	100	2(1+1)
AG 508	Practical Crop Production – I (*Kharif* crops)	Core	0	0	100+0	100	1(0+1)
AG 509	Intellectual Property Rights	AEC C	40	50	0+10	100	1(1+0)
	Elective Course						
AG 510A	Agricultural Journalism	Elective	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 minimum 30% marks in External, Practical/Assignment separately,
40% in individual subject and 50% marks in semester aggregate.

Elective Course

Elective Course (any one)	
Sub. Code	**Subject Name**
AG 510A	Agricultural Journalism
AG 510B	Landscaping
AG 510C	Food Safety and Standards
AG 510D	Biopesticides & Biofertilizers

Semester-VI

Theory Papers			Marks Allocation				Credit
			Theory		Practical / Assignment	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 601	Rainfed Agriculture & Watershed Management	Core	30	50	15+5	100	2(1+1)
AG 602	Protected Cultivation and Secondary Agriculture	Core	30	50	15+5	100	2(1+1)
AG 603	Diseases of Field and Horticultural Crops and their Management-II	Core	30	50	15+5	100	3(2+1)
AG 604	Post-Harvest Management and Value Addition of Fruits and Vegetables	Core	30	50	15+5	100	2(1+1)
AG 605	Management of Beneficial Insects	Core	30	50	15+5	100	2(1+1)
AG 606	Crop Improvement-II *(Rabi crops)*	Core	30	50	15+5	100	2 (1+1)
AG 607	Practical Crop Production – II (Rabi crops)	Core	0	0	100	100	1(0+1)
AG 608	Principles of Organic Farming	Core	30	50	15+5	100	2(1+1)
AG 609	Farm Management, Production & Resource Economics	Core	30	50	15+5	100	2(1+1)
AG 610	Principles of Food Science & Nutrition	Core	40	50	0+10	100	2(2+0)
	Elective Course						
AG 611A	Weed Management	Elective	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 subject and 50% marks in semester aggregate.

Elective Courses (any one)	
Sub. Code	**Subject Name**
AG 611A	Weed Management
AG 611B	Micro Propagation Technologies
AG 611C	Hi-Tech Horticulture
AG 611D	System Simulation and Agro-Advisory

Semester-VII

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

Theory Papers			Marks Allocation (Tentative)				Credit
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 701	General Orientation & On Campus Training by Different Faculties	SEC	0	0	50	50	14
AG 702	Village Attachment and Swachh Bharat Abhiyan Activities	SEC	0	0	400	400	
AG 703	Unit Attachment in University/College. KVK/Research Station	SEC	0	0	250	250	
AG 704	Plant Clinic	SEC	0	0	100	100	2
AG 705	Agro-Industrial Attachment	SEC	0	0	150	150	4
AG 706	Project Report Preparation, Presentation and Evaluation	SEC	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 subject and 50% marks in semester aggregate.

Semester-VIII

Theory Papers			Marks Allocation				Credit
			Theory		Practical	Total	
Subject Code	Subject Name	Type	Internal	External			
AG 801	Production Technology for Bioagents and Biofertilizer	SEC	0	0	100	100	0+10
AG 802	Seed Production and Technology	SEC	0	0	100	100	0+10
AG 803	Mushroom Cultivation Technology	SEC	0	0	100	100	0+10
AG 804	Soil, Plant, Water and Seed Testing	SEC	0	0	100	100	0+10
AG 805	Commercial Beekeeping	SEC	0	0	100	100	0+10
AG 806	Poultry Production Technology	SEC	0	0	100	100	0+10
AG 807	Commercial Horticulture	SEC	0	0	100	100	0+10
AG 808	Floriculture and Landscaping	SEC	0	0	100	100	0+10
AG 809	Food Processing	SEC	0	0	100	100	0+10
AG 810	Agriculture Waste Management	SEC	0	0	100	100	0+10
AG 811	Organic Production Technology	SEC	0	0	100	100	0+10
AG 812	Commercial Sericulture	SEC	0	0	100	100	0+10
AG 813	Agri Business Management	SEC	0	0	100	100	0+10
AG 814	Agro-Advisory Services	SEC	0	0	100	100	0+10
AG 815	Nursery Management	SEC	0	0	100	100	0+10
TOTAL			**0**	**0**	**200**	**200**	**0+20**
*Modules for Skill Development and Enreprenurship: A student shall register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package ofmodules in the semester-VIII.							
Note :-	**(i)**	**All courses are compulsory which having 183 credit hours.**					

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.

The total credit of **B.Sc. (Hons.) AG** Programme is **179**. The minimum credit required for award of degree shall be 179. However a student may earn minimum 4 credits through MOOCs/Coursera and have the option either to adjust the same 4 credits by leaving an elective paper else go for additional credits.

AG 101	Fundamentals of Horticulture	2(1+1)

Course objective-

- To learn about 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 botanicalclassification; 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, polliizers 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/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.

Course outcome:

At the end of course students will be able to

CO1: Demonstrate a fundamental understanding of plant identification, propagation, orchard establishment, use and maintenance of plant material best suited for conventional and sustainable horticulture.

CO2: Apply horticultural skills and knowledge to operate various business entities found in the horticultural industry.

CO3: Demonstrate an understanding of the composition, fertility and biology of soil and how they relate to good plant growth.

CO4: Identify and practice safe use of tools, equipment and supplies used in horticulture careers.

CO5: Identify the research career opportunities in the horticulture industry as well as emerging trends.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2, L3	H	L	H	L	H	H	M	H	H	H	L	M	H	L
CO2	L3, L1	H	M	M	H	M	M	M	M	M	M	-	M	L	H
CO3	L1, L3	M	H	H	-	H	-	M	L	H	M	L	-	H	H
CO4	L2	H	M	-	-	H	H	-	-	H	H	-	H	M	L
CO5	L2, L4	H	L	M	M	-	-	M	-			-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4 , CO5
CD5	Industrial visit / Field visit	CO4 , CO5

AG 102	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)

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: Importanceand classification. Structures of Monosaccharides, Reducing and oxidizing properties ofMonosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.

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 andtheir 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 aminoacids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paperchromatography/ 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.

Reference:

1. NK Gupta and Sunita Gupta, 2017. Fundamentals of plant Biochemistry and biotechnology. Kalyani Publication
2. BD Sing, 2001. Biotechnology Expanding Horizon. Kalyani Publication
3. L. Nelson; Michael M. Cox, Lehninger Principles of Biochemistry. Seventh Edition| ©2017David
4. H.S.Chawla, Introduction to plant biotechnology. 2001. Pinnalani for Oxford & IBH publishing Co. Pvt. Ltd. New Delhi.

Course Outcome:

At the end of the course, students will be able to –

CO1 Know the structure and functions of cell organelles
CO2 Classify biomolecules with structure and functions
CO3 Discuss the pathways of biomolecules and regulations
CO4 Identify the biomolecules in given sample
CO5 Apply for entrepreneurship and crop improvement

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L3	H	-	-	-	M	M	-	-	-	-	-	-	L	-
CO2	L1, L4	H	-	M	-	-	-	-	-	-	-	-	-	L	-
CO3	L2	H	-	-	H	H	-	-	-	-	-	-	-	-	-
CO4	L2, L3	M	L	H	-	-	-	-	L	-	-	-	-	-	L
CO5	L3, L6	H	L		H	-	M	-	L	L	-	L	H	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO5
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO4, CO5
CD5	Industrial visit / Field visit	CO4,CO5

AG-103	Fundamental of Soil Science	3(2+1)

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 andinorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field.Study of soil sampling tools, collection of representative soilsample, 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 organic matter content of soil.

Course Outcome

CO1: Knowledge of rocks, minerals and soil formation.

CO 2: Examine various horizon of soil profile and development

CO3: Role of physical, chemical and biological properties of soil in relation to crop production.

CO 4: Classify soils of India to have knowledge of soil taxonomy.

CO5: Differentiate the beneficial and harmful effects of macro and micro nutrients.

CO 6: Role of microorganisem in soil.

References:-

1. Boul S.W., Hole R.D., McCracken 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. TataMcGraw Hill publishingCo. 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) IntroductorySoilScience,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

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

CO	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,	H	H		M	L	M	H	M	L	H	L	L	H	-
CO2	L4	H	H	M	M	L	L	H	-	-	H	-	H	M	M
CO3	L1	H	-	M	M	-	-	M	-	-	H	-	-	L	H
CO4	L4	H	-	M	M	L	-	H	M	H	H	L	L	L	M
CO5	L4	H	M	L	H	H	M		-	-	H	L	H	M	L
CO6	L1	H						L	-	-	H	L	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5,CO6
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO5
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO4, CO5
CD5	Industrial visit / Field visit	CO4,CO5

AG-104	Introduction to Forestry	2(1+1)

Course objective-

- To ensure long-term forest productivity and conservation of forest resourse throufh promt reforestation, soil conservation, afforestation and other measures.
- To protect water quality in streams, lake 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 menstruation – 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 calipers 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 lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

References-

1. Eyle, Alexandra. 1992. Charles Lathrop Pack: Timberman, Forest Conservationist, and Pioneer in Forest Education. Syracuse, NY: ESF College Foundation and College of Environmental Science and Forestry. Distributed by Syracuse University Press. Available: Internet Archive.
2. Hammond, Herbert. 1991. Seeing the Forest Among the Trees. Winlaw/Vancouver: Polestar Press, 1991.

3. Hart, C. 1994. Practical Forestry for the Agent and Surveyor. Stroud. Sutton Publishing. ISBN 0-86299-962-6
4. Hibberd, B.G. (Ed). 1991. Forestry Practice. Forestry Commission Handbook 6. London. HMSO. ISBN 0-11-710281-4
5. Kimmins, Hammish. 1992. Balancing Act: Environmental Issues in Forestry. Vancouver: University of British Columbia Press.
6. Maser, Chris. 1994. Sustainable Forestry: Philosophy, Science, and Economics. DelRay Beach: St. Lucie Press.
7. Miller, G. Tyler. 1990. Resource Conservation and Management. Belmont: Wadsworth Publishing.
8. Nyland, Ralph D. 2007. Silviculture: Concepts and Applications. 2nd ed. Prospect Heights: Waveland Press.
9. Oosthoek, K. Jan/ Richard Hölzl (eds.) 2019. Managing Northern Europe's Forests. Histories from the Age of Improvement to the Age of Ecology. New York/Oxford: Berghahn Publ.
10. Radkau, Joachim Wood: A History, ISBN 978-0-7456-4688-6, November 2011, Polity
11. Stoddard, Charles H. 1978. Essentials of Forestry. New York: Ronald Press.

Course outcome-

CO1: Recognize various harvesting, transportation, and processing systems used in the management of forest resources and production of forest products.

CO2: Illustrate and discuss about develop and evaluate management plans with multiple objectives and constraints.

CO3: Demonstrate and discuss learn how to develop and apply silvicultural prescriptions appropriate to management objectives.

CO4: Examine and develop forest inventory information and project future forest, stand, and tree conditions.

CO5: Know about Nursery lay out, seed sowing and experiment vegetative propagation techniques, Forest plantations and their management. Visits of nearby forest based industries.

Mapping between Programme Outcomes (POs) and Course Outcomes(COs):

	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	M	M	H	H	M	H	M	H	M	M	H	H	M	M
CO2	L2,L3	H	H	H	H	H	H	M	M	M	M	M	M	-	M
CO3	L2,L3	H	M	H	H	M	M	M	H	M	M	M	M	M	-
CO4	L4, L6	H	H	M	H	M	M	M	H	H	M	H	H	H	H
CO5	L1,L4,	M	H	M	M	M	M	M	M	M	M	H	H	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit/ Farm visit

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3
CD4	Self- learning advice using internets	CO3, CO4
CD5	Industrial visit / Farm visit	CO1, CO2,CO3,CO4

AG 105	Comprehension & Communication Skills in English	2(1+1)

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, speeches (scientific, commercialand 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 Outcomes:-

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

CO1: Draw connections between personal experiences and the world of texts, and share responses with others.

CO2: Identify and differentiate the different types of texts and techniques for strengthening vocabulary.

CO3: Identify common sentence types and common errors in sentence composition.

CO4: Produce coherent and unified paragraphs with adequate support and detail.

CO5: Understand the purpose of professional writing and obtain the important tips for interview.

Mapping between Programme outcomes (POs) and Course Outcomes (COs):

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3, L6	-	L	L	-	M	-	H	H	-	H	H	M	L	M
CO2	L2, L4	-	-	M	M	-	-	H	M	-	L	L	-	-	-
CO3	L2	-	-	M	M	L	-	M	H	-	-	-	-	-	-
CO4	L3, L6	-	-	-	L	-	-	L	-	-	L	-	-	-	L
CO5	L2	-	L	L	M	M	-	L	L	-	M	M	M	-	L

H- High, M- Moderate, L- Low "-"for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between CD and CO

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CD5

AG 106	Fundamentals of Agronomy	4(3+1)

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 with reference to 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 densityand infiltration rate, Measurement of irrigation water.

References:

1. ICAR. 2010. Handbook of Agriculture (6^{th} 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 (2^{nd} edition), Agrobios (India), Jodhpur
4. Reddy, T.Yellamanda and Reddy, G.H. Sankara. 2016. Principles of Agronomy (2^{nd} edition) , Kalyani Publishers, Ludhiana
5. Reddy, S.R.2012. Principles of Crop Production (4^{th} edition), Kalyani Publishers, Ludhiana.Gupta, O.P. 2005. Weed Management: Principles and Practices (2^{nd} Ed) Agribios (India) Jodhpur.

Course Outcomes

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

CO 1. Define agriculture, its importance, present status, scope, future prospect and cropping seasons of India.

CO 2. Understand the impact of legal and ethical environment on agriculture.

CO 3. Illustrate about crop cultivation and management practices.

CO 4. Know principles of agriculture practices, modern systems of farming of agricultural crops and best cropping management suitable in local climate.

CO 5. Adapt the best crop management technologies in problematic areas in agricultural field.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	POS 1	POS 2
CO1	L1	H	-	M	-	L	-	H	-	M	H	-	-	H	-
CO2	L2	H	M	L	-	L	-	M	-	M	H	-	-	M	H
CO3	L3	H	M	-	-	L	M	M	M	M	H	-	H	H	-
CO4	L1	H	L	L	-	L	M	M	M	H	M	-	-	H	M
CO5	L3	M	H	H	M	L	H	M	-	H	M	M	H	M	-

- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit/ Farm visit

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit/ Farm visit	CO4

AG 107A	Introductory Biology*	2(1+1)

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, Evolutionand Eugenics

UNIT-B Binomial nomenclature and classification Cell and cell division

UNIT-C Morphology offlowing plants. Seed and seed germination

UNIT-D Plant systematic- viz; Brassicaceae, Fabaceae andPoaceae

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

Practical

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

Reference:

1. NK Gupta and Sunita Gupta, 2017.Fundamentals of plant Biochemistry and biotechnology. Kalyani Publication
2. L. Nelson; Michael M. Cox, Lehninger Principles of Biochemistry. Seventh Edition ©2017David

Course outcomes:-

At the end of the course, students will be able to –

CO1 Understand the origin of life and their characteristics and evolution

CO2 Know the cell and their structure and functions

CO3 Understand the concept of flowers and seed

CO4 Classify the plant family and their characteristics

CO5 Know the role of animals in agriculture

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO S 1	PO S 2
CO1	L2	H	L	H	-	-	-	-	-	-	-	-	-	L	-
CO2	L1,L2,L3	H	L	L	L	-	L	-	M	-	-	-	-	-	-
CO3	L1	H	-	-	L	-	-	-	-	-	-	-	-	-	-
CO4	L4	M		-	H	-	-	M	-	-	L	-	-	L	L
CO5	L1	H	-	L	-	M	-	-	M	M	-	L	H	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3 , CO4, CO5
CD3	Seminars	CO2, CO3
CD4	Self- learning advice using internets	CO1, CO5
CD5	Industrial visit / Field visit	CO3, CO5

AG 107B	Elementary Mathematics*	2(2+0)

Course Objectives

- To learn about straight lines and circles.
- To apply knowledge of basic geometry skills to solve problems.
- To know about the 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), Changeof 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 formof equation of line, Intercept form of equation of line, Normal form of equation of line, Generalform of equation of line, Point of intersection of two st. lines,

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

Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equationof circle passing through three given points, Equation of circle whose diameters is line joining twopoints (x1, y1) & (x2,y2), 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 x2 + y2 = a2.

UNIT-C Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problemson continuity, Differentiation of xn , ex , sin x & cos x from first principle, Derivatives of sum,difference, product and quotient of two functions, Differentiation of functions of functions (Simpleproblem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation bysubstitution method and simple problems based on it.

UNIT-D Differentiation of Inverse Trigonometricfunctions. Maxima and Minima of the functions of the form y=f (x) (Simple problems based onit).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 undersimple 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 theirevaluation**.**

Course Outcome

CO1. Competency in the areas that comprise the core of the geometry, calculus and matrices

CO2. Demonstrate the ability to understand mathematical proofs and derivations

CO3. Able to use appropriate methods to solve mathematical problems

CO4. Able to construct appropriate mathematical models to solve a variety of practical problems

CO5. Obtain a full-time position in a related field or placement

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	POS1	POS2
CO1	L1	H	M	-	M	H	M	L	M	M	H	M	M	-	-
CO2	L2,L3	H	M	-	H	M	M	M	M	L	M	M	M	L	M
CO3	L1	H	M	-	M	M	H	L	M	H	M	M	H	-	L
CO4	L1,L3	H	L	M	M	-	M	L	M	M	H	M	H	L	L
CO5	L2	H	-	H	H	-	H	M	H	H	M	M	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3 , CO4, CO5
CD3	Seminars	CO2, CO3
CD4	Self- learning advice using internets	CO1, CO5
CD5	Industrial Visit / Field Visit	-

AG 108	Agricultural Heritage	1(1+0)

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.

Course Outcomes:

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

CO1. Know the basics of the agriculture, till age and evolution of agriculture from different Periods from Vedas to modern agriculture

CO2. Observe ancient Agricultural Practices & Its relevance to modern agriculture practices.

CO3. Examine Traditional Technical Knowledge.

CO4. Discover Our Journey (Developments) in Agriculture and Vision for the Future.

CO5. Identify the status of farmers in society.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS 1	PS 2
CO1	L1	H	L	L	M	M	M	-	L	M	H	L	M	M	-
CO2	L2	M	L	-	L	L	H	L	-	L	L	M	M	H	L
CO3	L4	H	L	-	L	L	H	M	M	L	L	L	H	-	M
CO4	L4	M	L	-	L	-	H	M	M	M	M	L	M	L	-
CO5	L2	H	L	-	-	L	M	L	L	-	-	-	M	L	-

H- High, M- Moderate, L- Low "-"for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between CO and CD:

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO1, CO5

AG 109	Rural Sociology & Educational Psychology	2 (2+0)

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.

References:

1. Doshi, S.L. 2007. Rural sociology. Rawat Publishers, Delhi.
2. Jayapalan, N. 2002. Rural sociology. Altanic Publishers, New Delhi.
3. Pujari, D. 2002. Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur
4. Bhushan, V. and Sachdeva, D.R. 2010. An introduction to Sociology, KitabMahal, New Delhi.
5. Rao, C.N.S. 2015. Sociology, S.Chand& Company, New Delhi.

Course Outcomes:

At the end of the course, a student will be able to understand –

CO1 Know the concept of rural sociology, its importance in agricultural extension, and characteristics of Indian rural society.

CO2 Discuss social groups, social stratification, culture, social values, social control and attitudes, leadership and training.

CO3 Describe about the educational psychology, intelligence, personality, perceptions, emotions, frustration, motivation, teaching and learning.

CO4 Create a bridge for understanding and importance of the characteristics of rural society, village institutions and social organizations. Discover lay leaders and train them.

CO5 Explain personality types, leadership types and emotions of human beings IV. Organize a training situation under village conditions.

Mapping between Programme Outcomes (Pos) and Course Outcomes (Cos)

Course outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	M	H	M	L	M	M	M	H	H	H	M	L	H	M
CO2	L2	M	M	M	H	H	L	M	L	L	H	H	L	M	-
CO3	L2	H	H	M	M	H	M	L	M	L	H	M	M	H	H
CO4	L4, L6	M	H	M	M	H	M	L	M	L	H	L	L	H	L
CO5	L2, L4	M	M	M	H	H	M	L	M	M	M	L	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4,CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4 , CO5
CD5	Industrial visit / Field visit	CO3, CO5

AG 110	Human Value and Ethics (Non Gradial)	1 (1+0)

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.

Reference:

1. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications
2. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
3. Professional Ethics and Human Values by Prof. DR.Kiran-Tata McGraw-Hill – 2013.

Course Outcomes:

At the end of the course students will able to:

CO1. Define the vision of life.

CO2. Understand the abilities and preferences and their implications.

CO3. Improve the thought process of selecting a logical choice.

CO4. Justify accomplishment, success and prosperity.

CO5. Improve the social, investigative, artistic, realist, and conventional aspect of life.

Mapping between Programme outcomes (Pos) and Course Outcomes (Cos):

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L4, L5	-	L	H	-	L	-	M	M	-	M	H	L	-	-
CO2	L6, L3	-	L	M	L	L	-	M	M	-	L	H	M	M	M
CO3	L1	-	L	M	L	M	-	H	M	-	M	H	M	-	-
CO4	L4	-	-	L	-	-	-	H	L	-	H	H	L	M	-
CO5	L4	-	L	M	-	M	-	H	M	-	H	H	M	-	L

H- High, M- Moderate, L- Low "-" for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between CD and Cos

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO1,CO2,CO3,CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO4, CO5

AG-111A/B/C	NSS/NCC/Physical Education & Yoga Practices	2(0+2)

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 camp in a year and one special camp for duration of 7 days at any semester break period in the two year.

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.

Course Outcomes

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

CO1: Know the community in which they work. Evaluate themselves in relation to their community.

CO 2: Identify the needs and problems of the community and involve them in problem solving develop among themselves a sense of social and civic responsibility**.**

CO3: Convert their knowledge in finding practical solutions to individual and community problems. Develop competence required for group-living and sharing of responsibilities

CO4: Improve skills in mobilizing community participation. Acquire leadership qualities and democratic attitudes

CO5: Develop capacity to meet emergencies, natural disasters, practice national integration and social harmony

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L1,L5	H	M	-	-	H	-	L	M	M	H	M	-	M	M
CO2	L2	H	M	-	H	M	M	M	M	L	M	M	-	-	-
CO3	L2	H	M	-	M	M	H	L	M	-	M	M	M	H	M
CO4	L6	H	L	M	-	-	-	L	M	M	M	M	M	L	-
CO5	L6	H	-	H	-	H	H	M	H	-	M	M	-	-	-

- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit/ Farm visit

Mapping between CO and CD:

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit/ Farm visit	CO4, CO5

AG 201	Fundamentals of Genetics	3(2+1)

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 transport of genetic information.
- To understand the functions of cell.

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 pseudoalleles.

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 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:

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, PratapGanj, New Delhi.
3. Singh, B.D. 2001.KalyaniPublishing House, New Delhi.
4. Strickberger, M.W.2001.Genetics. Prentice Hall of india. Pvt. Ltd., New Delhi

Course outcomes:-

At the end of this course students will be able to

CO1: Comprehensive, detail understanding of the chemical basis of heredity, specially in crops to impove and develop the new varieties of plants.

CO2: Understand the genetic concepts; affect broad societal issues including health, disease, food, natural resources and environmental sustainability.

CO3: Know the design, execute, and analyze the results of genetic experimentation in plant system.

CO4: Apply the genetic principles to identify the genetic variations in plants.

CO5: Understand the role of genetic engineering in the industries, related to biotechnology, pharmaceutical, energy and other fields.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Blooms level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2,L6	H	M	M	L	H	H	H	M	M	L	L	M	H	M
CO2	L2	H	M	-	L	M	M	M	H	L	M	L	M	H	M
CO3	L1,L4	H	-	L	H	H	H	M	M	H	M	M	L	M	L
CO4	L3	M	L	-	M	L	M	L	L	L	H	M	H	L	H
CO5	L2	H	H	L	M	L	H	H	M	M	L	M	M	H	M

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4, CO5
CD5	Industrial visit / Field visit	CO3, CO5

AG 202	Agricultural Microbiology	2(1+1)

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 Azotobacterfrom soil.Isolation of Azospirillumfrom 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.

Course Outcome

At the end of this course students will be able to

CO1: Know the basic microbial structure, function and study the comparative characteristics of prokaryotes and eukaryotes.

CO2: Discuss the various physical chemical growth factors of bacteria and relate with growth Curve

CO3: Relate the various relationships between Plant Pathogens and Host

CO4: Discuss the role of important microbes in Carbon cycle, nitrogen cycle, Phosphorus Cycle and Sulpher cycle

CO5: Identify and analysis the microbes by using different stain

CO6: Isolate microorganism from soil and root of plant**.**

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Level of Taxonomy	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L1	H	L	L	-	-	L	H	M	L	H	L	-	L	-
CO2	L2,L4	H	L	M	L	M	M	H	M	-	H	M	-	-	L
CO3	L4	H	M	H	M	-	L	L	L	M	M	M	L	M	L
CO4	L1,L 2	H	-	M	-	-	L	H	L	H	H	L		M	-
CO5	L2,L4	H	M	M	M	H	H	L	L	-	H	L	M	-	M
CO6	L4	H	M	M	M	H	H	-	L	L	H	L	M	-	M

H- High, M- Moderate, L- Low "-"for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between CD and CO

CD1	Lectures by use of board/LCD/	CO1,CO2,CO3,CO4
CD2	Tutorial/Assignments	CO1,CO2,CO3,CO4
CD3	Seminar	CO4
CD4	Self learning	CO1,CO2,CO3,CO4
CD5	Field Visit	CO5,CO6

AG 203	Introductory Soil and Water Conservation Engineering	2(1+1)

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 Principlesof erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund andbench terracing.

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

UNIT-E Winderosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion controland 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 water ways. Designof contour bunds. Design of graded bunds.Design of bench terracing system.Problem on winderosion.

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.

Course Outcome:

At the end of the course, a student will be able to understand –

CO1 Apply various methods of soil erosion and forms of water erosion, classification of gully control measures or structures.

CO2 Knowledge of soil loss equation and it can estimate long - term annual soil loss and guide conservationists on proper cropping, management, and conservation practices.

CO3 Demonstrate the contour strip cropping designed to minimize soil erosion and contour bunds which can save soils from erosion.

CO4 Understand the grassed waterways designed to move surface water across farmland without causing soil erosion and various water harvesting techniques.

CO5 Understand the wind erosion, centrifugal pumps and various pressurized irrigation methods.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	M	-	M	M	H	M	-	M	M	-	M	H	M	H
CO2	L5	H	M	M	M	H	H	-	M	-	-	H	H	-	M
CO3	L4	H	H	H	H	H	M	M	M	-	-	M	H	L	H
CO4	L3	H	M	H	H	M	-	H	M	M	M	M	H	M	M
CO5	L2	-	M	H	H	H	M	M	M	M	M	H	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO3,CO4
CD4	Self- learning advice using internets	CO1,CO2,
CD5	Industrial visit / Field visit	CO5,CO4

AG 204	Fundamentals of Crop Physiology	2(1+1)

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, TCAcycle 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, imbibitions, osmosis, plasmolysis,

Measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments

Through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue testfor mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO2assimilation by Infra Red Gas Analyser (IRGA).

Reference:

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.

Course Outcome:

At the end of the course, students will be able to –

CO1 Know the role of crop physiology in crop improvement

CO2 Identify the deficiency symptoms of nutrients

CO3 Know the metabolism pathways.

CO4 Calculate plant growth and analysis

CO5 Use of growth hormone

Mapping between Programme Outcome (POs) and Course Outcome (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H		L	M	H	L	-	-	-	-	-	-	-	L
CO2	L2	L	H	M	L	H	-	-	L	L	-	-	-	L	-
CO3	L1	M	L	L	-	-	-	-	-	-	-	-	-	-	-
CO4	L4	-	-	-	-	H	M	M	-	-	-	-	-	-	-
CO5	L3	-	-	-	-	-	-	M	-	L	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Field Visit	CO2, CO4, CO5

AG 205	Fundamentals of Agricultural Economics	2(2+0)

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 higelight the importance of agriculture in the 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, 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, 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.

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 (10^{th} 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 outcome:

At the end of this course students will be able to

CO1: Apply economics principles to understand the conduct and performance of the Agricultural industry.

CO2: Determine the concept and measurement of price elasticity, income elasticity and cross elasticity.

CO3: Understand the macroeconomics aspects of the economy as they affect the agricultural sector. Estimate & investigate critique and evaluate the cost benifites.

CO4: Make them aware of the availability of rich natural endowments to achieve sustainabl Agricultural development. With this knowledge they can challenge the problems of unemployment inequality, shortage of food productions, poverty, and be useful to compete advanced agricultural economie s.

CO5: Identify elements of busines success in agriculture] and food-processing as well as elements that determine economic role of agriculture in national economy. Different financial sources are known to the students and they can act as a good banker for farmers.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	-	-	M	-	-	H	M	M	-	H	M	H
CO2	L5	M	M	M	-	M	-	--	H	H	H	-	H	H	M
CO3	L4	H	M	-	-	-M	-	H	-	-	L	-	M	H	M
CO4	L3	H	M	-	-	H	L	-	H	M	M	-	M	M	M
CO5	L2	M	L	M	-	M	-	L	M	M	-	-	H	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2
CD3	Seminars	CO3,CO4
CD4	Self- learning advice using internets	CO1,CO2,
CD5	Industrial visit / Field visit	CO5,CO4

AG 206	Fundamentals of Plant Pathology	4(3+1)

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. Historyof Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron andclassification 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, 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 andreproduction.

UNIT-D Viruses: nature, structure, replication and transmission. Study of phanerogamic plantparasites.Nematodes: General morphology and reproduction, classification, symptoms and nature ofdamage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.)Growth and reproduction of plant pathogens.Liberation / dispersal and survival of plantpathogens.

UNIT-E Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes,toxins and growth regulators in disease development. Defense 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 equipments and microscopy.Collection and preservationof disease specimen.Preparation of media, isolation and Koch's postulates. General study ofdifferent structures of fungi. Study of symptoms of various plant diseases.Study of representativefungal genera.Staining and identification of plant pathogenic bacteria.Transmission of plantviruses.Study of phanerogamic plant parasites.Study of morphological features and identification of plant parasitic nematodes.Samplingand extraction of nematodes from soil and plant material, preparation of nematode mounting.Study of fungicides and their formulations.Methods of pesticide application and their safeuse. 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 Estern 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.

Course outcome

At the end of this course students will be able to

CO1 Discuss about concepts of plant pathogens, major disease causing organisms and their etiology.

CO2 Provide specific knowledge about host pathogen interactions.

CO3 Identify the plant disease is the initial stage.

CO4 Give specific knowledge about environment and disease development in plant.

CO5 Give specific knowledge about fungicides and their formulations and calculation of fungicide spray concentration.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Blooms level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	H	M	L	M	-	L	H	H	H	-	_	H	-
CO2	L1	H	M	L	H	H	M	-	L	H	L	-	-	-	-
CO3	L2	H	M	M	H	H	M	M	-	H	-	-	-	M	L
CO4	L1	H	M	L	H	M	M	H	H	H	H	-	-	H	-
CO5	L2, L1	H	H	H	M	M	-	H	H	H	M	-	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4, CO5
CD5	Industrial Visit / Field Visit	CO2, CO3

AG-207	Fundamentals of Entomology	4(3+1)

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 Animalkingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta withother classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting.Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications ofinsect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus.Structure of male and female genital organ. Metamorphosis and diapause in insects.Types oflarvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous,secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Majorsensory 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 ofbiotic factors – food competition, natural and environmental resistance.

UNIT-C Categories of pests.Concept of IPM, Practices, scope and limitations of IPM.Classificationof insecticides, toxicity of insecticides and formulations of insecticides. Chemical controlimportance,hazards and limitations. Recent methods of pest control, repellents, anti feed ants,hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Applicationtechniques 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 ofclass Insecta upto Orders, basic groups of present day insects with special emphasis to ordersand families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae,Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera:Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae,Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae.

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

Practical

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 ofinsect population and damage.

Reference:

1. Chapman .R.F.1981. Insect Structure and Function, ELBS Publishers New Delhi.
2. David B.V. and Ananthakrishnan .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.

Course Outcome:

At the end of this course students will be able to

CO 1: Observe the morphological characteristics, feeding habit and habitat of agriculturally important insect-pest.

CO 2: Apply concepts and analytical approaches in evolutionary biology, genetics and other areas of insect biology of the student's choice.

CO 3: Categorize insects based on basic ecological, behavioural, morphological, physiological, or developmental attributes.

CO 4: Examine insects deeply within a biological level of analysis and make strategies for successful pest management strategy.

CO 5: Understand about different families and orders of class Insecta which cause economic losses to human beings.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L2	H	-	-	M	H	-	M	L	M	H	-	M	L	-
CO2	L3	H	M	H	H	H	M	H	M	H	H	-	-	M	-
CO3	L4	M	H	H	-	H	-	M	L	H	M	L	-	H	L
CO4	L2, L4	H	M	-	-	H	H	-	-	H	H	-	H	-	M
CO5	L2	H	-	-	M	-	-	M	-	-	M	-	-	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4,CO5
CD3	Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3 CO5
CD5	Industrial visit / Field visit	CO1, CO5

AG 208	Fundamentals of Agricultural Extension Education	3(2+1)

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; handlingand use of audio visual equipment's 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.

References-

1. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.
2. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
3. MuthaiahManoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
4. Rathore, O. S. et al., 2012, Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
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 Publishing Academy, Udaipur.
7. Van Den Ban, A. W. and Hawkins, H. S., Agricultural Extension, S. K .Jain for CBS Publishers & Distributors, New Delhi.
8. 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, Agroteh Publishing Academy, Udaipur.

Course outcomes-

At the end of course stundents will be able to

CO1: Know about the Education, types of education, ExtensionProgramme planning Meaning, Process, Principles and Steps in Programme Development.

CO2: Discuss about the Extension systems in India: Extension efforts in Pre-independence era. Know how to use of audio visual equipment's.

CO3: Recognize the new trends in agriculture extension: privatization extension. Able to create a news story, able to make a news and use of community radio.

CO4: Demonstrate of some activity with the help of AV aids so that students can use the aids and enhance their skill in different areas.

CO5: Formulate a group and assign to organize a small peogramme.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course out Come	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	H	H	H	H	M	H	M	L	H	M	H	M	H
CO2	L1,L2	M	H	M	M	H	M	H	H	M	M	M	H	H	-
CO3	L2, L3, L6	H	H	M	H	H	M	L	H	M	M	M	H	H	M
CO4	L3,	M	M	H	H	M	M	L	M	M	M	L	M	M	L
CO5	L4, L6	L	H	H	H	H	H	L	H	M	M	L	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO4,CO5
CD5	Industrial visit / Field visit	CO5

AG 209	Communication Skills and Personality Development	2(1+1)

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.

References:

1. Sandhu, A. S. (1999). Textbook on Agricultural Communication; process and methods oxford RIBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. (1960). The process of Communication. Nw Yark, Holt, Rinehart and Winston Inc.
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 and Management 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 Publishing Academy, Udaipur.

Course Outcomes:

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

CO1: Development of all-round personalities with mature outlook to function effectively in different circumstances.

CO2: Design broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.

CO3: Take part effectively in various selection procedures adopted by the recruiters.

CO4: Conduct effective business correspondence and prepare a business report which produces results.

CO5: Generate self-confidence individuals by mastering inter-personnel skills, team management skills, and leadership skills.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course Outcome	Blooms Level	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L6	L	M	M	M	M	-	H	H	-	H	H	M	M	L
CO2	L6	-	L	M	M	M	-	H	M	-	L	M	H	M	L
CO3	L3	M	M	M	M	M	-	L	H	L	H	M	H	-	L
CO4	L6	M	H	H	H	M	-	L	H	-	M	L	H	L	-
CO5	L6	L	L	M	M	M	-	L	M	-	M	M	H	-	-

H- High, M- Moderate, L- Low "-"for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO2, CO5

AG-301	Crop Production Technology – I (*Kharif* crops)	3(2+1)

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, study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, 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 (5^{th} Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.

Course Outcome:

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

CO1: Know about origin, geographical distribution and economic importance of Kharif crops

CO2: Know about Soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.

CO3: Demonstate the comparative benefits of the different kharif crops

CO4: Identify the constraints in production of oilseeds and pulses.

CO5: Understand the production technology of kharif cereals and millets to fulfill the need of human consumption and milch cattle.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	L	M	M	M	L	M	L	M	M	L	M	H	M
CO2	L1	H	L	M	H	H	L	M	M	M	H	L	M	H	L
CO3	L3	H	-	L	M	M	L	L	H	H	M	M	L	M	H
CO4	L2	H	L	L	L	M	L	H	M	H	H	L	L	M	M
CO5	L2	H	H	H	H	M	L	M	M	M	M	H	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Method

CD1	Lectures by use of board /LCD
CD2	Tutorial/ Assignments
CD3	Seminar
CD4	Self learning
CD5	Field Visit

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO1,CO4

AG-302	Fundamentals of Plant Breeding	3(2+1)

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 inbreedingdepression, 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 prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods anduses;

UNIT-E Breeding for important biotic and abiotic stresses; Biotechnological tools-DNAmarkers and marker assisted selection. Participatory plant breeding; IntellectualProperty 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 segregating populations.Methods of calculating mean, range, variance, standard deviation, heritability.Designs used in plant breeding experiment, analysis of Randomized Block Design and components of genetic variance. 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:

1. Alard, R.W. 2000.Principles of Plant Breeding. John Willey & 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.

Course Outcome:

At the end of this course students will be able to

CO1 Understand the selection, its methods and utilize them to improve and develop crop verities.

CO2 Apply and utilize the genetic principles of heredity to improve the genotype of crops.

CO3 Apply the plant breeding methods to develop resistant and high nutritive varieties.

CO4 Increase the farm yield to get higher income on farm by developing highy yielding crop varieties.

CO5 Identify and evaluate the crops genotype to improve their characters.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2, L6	H	l	M	M	-	L	L	-	M	-	M	L	M	L
CO2	L3, L6	M	L	-	H	L	M	L	L	L	M	-	-	L	L
CO3	L3, L6	H	-	M	L	H	L	L	M	M	M	L	M	H	M
CO4	L6	H	L	L	H	L	M	L	L	M	L	M	L	H	-
CO5	L5, L6	M	-	L	M	H	-	L	L	-	L	L	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3,CO4

CD5	Industrial visit	CO3, CO4, CO5

AG -303	Agricultural Finance and Co-Operation	3(2+1)

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.

Practicals.

Determination of 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 incom 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 its value add products. Seminar on selected topics.

References:

1. Reddy, S. and Raghu Ram, P. "Agricultural Finance and Managament" 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. Krishnaswami, O.R. "Fundamental of Cooperation"
6. Nelson, A.G. and Murray, W.G. 1988 "Agricultural Finance" IOWA State University Press, Amies, IOWA, USA

Course Outcome

At the end of this course students will be able to

CO1: Explain the broad features of Indian financial institutions with its apex banks' objectives andpurview. Also understand the instruments to control credit in the country.

CO2: Effectively narrate the kinds and components of money with its regulatory system. Apply economics principles to understand the conduct and performance of the agricultural industry

CO3: Identify the existence and development of non- banking financial institutions; know the important role of mutual fund .LIC investment companies etc. Utilize and effectively participate in the development process.

CO4: Students came to know different banking principles and procedures. Students visited different financial institutions viz., commercial banks, cooperative societies, RRBs, LDBs etc and they gained the practical banking knowledge.

CO5: Demonstrate the role and significance of foreign exchange rate and its markets with its impact on various sectors in the economy.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2,	H	M	M	-	L	-	--	L	-	-	-	M	M	M
CO2	L3	M	-	L	-	L	M	-	H	--	-	-	H	H	M
CO3	L2	H	L	M	-	M	L	-	M	L	M	-	L	H	H
CO4	L4	M	L	L	-	M	L	-	M	L	-	-	M	L	M
CO5	L3	M	M	-	-	M	M	-	M	H-	M	-	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO4,
CD2	Tutorials/Assignments	CO2,CO4
CD3	Seminars	CO1,CO5
CD4	Self- learning advice using internets	CO2,CO3.CO4.CO5
CD5	Industrial visit / Field visit	CO1.CO2,CO3.CO4

AG 304	Agricultural Informatics	2(1+1)

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 AgricultureComputer 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.

Reference:

Agro-Informatics Book by G. Vanitha

Course Outcomes:

At the end of the course, a student will be able to

CO1: Understand analogy of computer

CO2: Basic knowledge of MS Office

CO3: Some basic knowledge of Internet and WWW

CO4: Use of IT application and different IT tools in Agriculture

CO5: Use of Decision support systems, Agriculture Expert System and Soil Information Systemsin Agriculture

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO 1	PSO 2
CO1	L2	L	-	L	-	M	L	H	L	-	-	L	L	-	-
CO2	L1, L2	L	-	L	-	H	L	M	L	-	-	L	M	-	L
CO3	L3	L	-	L	-	M	L	L	L	-	-	L	L	-	-
CO4	L4, L5	H	L	H	M	M	M	-	-	L	M	-	M	-	L
CO5	L3, L4, L5	H	L	M	M	M	L	-	-	L	L	-	L	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3,CO4
CD3	Seminars	CO4, CO5
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO4, CO5

AG-305	Farm Machinery and Power	2(1+1)

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.

Practicals

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Familiarization with different types of primary and secondary tillage implements: mould board plough, disc plough and disc harrow . Familiarization with seed metering mechanism and calibration of seed drill, Familiarization with different types of sprayers and dusters Familiarization with different inter-culture implement, Familiarization with harvesting and threshing equipments and machinery.

References:

1. Jagdeeswar Sahay, Elements of Agricultural Engineering.
2. A.M. Michael and T. P. Ojha Principles of Agricultural Engineering, Vol. 1
3. Kepner, Bainer and Bergar Principles of Farm Machinery
4. Barger, Carleton, Mckilben and Bainer Tractor and their Power Units

Course Outcomes:

At the end of the course, a student will be able to

CO1: Recognize various sources of farm power and compare them

CO2: Explain the working of IC Engines and their uses in modern equipments

CO3: Describe various parts of tractors and evaluate the financial mechanism

CO4: Estimate the capacity and requirements of using farm implements

CO5: Explain the various implements used in agriculture farm for various purposes

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L5	L	-	-	H	-	M	-	-	-	-	-	M	-	L
CO2	L2,L3	-	M	L	H	-	M	-	-	-	-	-	-	L	-
CO3	L1, L5	-	-	L	-	-	M	-	L	-	-	-	-	-	L
CO4	L5	-	L	-	-	-	-	H	M	-	-	-	-	-	-
CO5	L2.L3	-	-	-	-	-	-	-	-	M	-	H	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO1, CO4, CO5
CD5	Industrial Visit / Field Visit	CO3,CO5

AG-306	Production Technology for Vegetables and Spices	2(1+1)

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:

1. Choudhary, B.R. (2009). A Text book on production technology of vegetables, Kalyani Publishers.
2. Yawalkar, K. S. (2008) Vegetable crops in India Agri-Horticultural, Pub. House. Nagpur
3. Rana, M.K. (2008) Olericulture in India Kalyani Publishers, New Delhi.
4. Dhaliwal, M.S. (2008). Handbook of Vegetable Crops, Kalyani Publishers, New Delhi.
5. Nath Prem, (1994) Vegetables for the Tropical Regions, ICAR New Delhi
6. Kamath, K.V (2007). Vegetable Crop Production Oxford Book Company

Course outcome

At the end of this course students will be able to

CO1: Understand the practical knowledge on specialized production techniques of vegetables and spices.

CO2: Understand the importance of vegetables & spices in human nutrition improved and national economy.

CO3: Apply the knowledge of quality requirement, production and techniques for export.

CO4: Managing skill for solving field problems and layout preparation.

CO5: Describe the kitchen gardening and their use.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,L2, L3	H	L	M	H	H	M	M	M	-	M	H	M	L	-
CO2	L2, L6	M	M	H	H	L	L	-	-	L	M	-	-	L	-
CO3	L1, L3	H	L	H	M	M	L	L	L	-	L	L	M	L	-
CO4	L3, L6	M	M	H	M	L	M	M	M	M	L	-	L	M	L
CO5	L2, L3	H	M	M	L	M	M	L	L	L	M	M	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2,CO3, CO5

AG-307	Environmental Studies and Disaster Management	3(2+1)

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 andover-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 andusing mineral resources, case studies. d) Food resources: World food problems, changes causedby agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewableenergy sources, use of alternate energy sources. Case studies.

UNIT-B f) Land resources: Landas a resource, land degradation, man induced landslides, soil erosion and desertification. Roleof an individual in conservation of natural resources.Equitable use of resources for sustainablelifestyles.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 andfunction of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desertecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystemdiversity and biogeographical classification of India. Value of biodiversity: consumptive use,productive use, social, ethical, aesthetic and option values.

UNIT-C Biodiversity at global, National andlocal levels, India as a mega-diversity nation.Hot-sports of biodiversity. Threats to biodiversity:habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species ofIndia. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.Environmental Pollution: definition, cause, effects and control measures of: a. Air pollutionb. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollutiong. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban andindustrial wastes. Role of an individual in prevention of pollution.Social Issues and the Environment: From Unsustainable to Sustainable

development, Urbanproblems 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. dies. Wasteland reclamation.Consumerismand waste products.Environment Protection Act.Air (Prevention and Control of Pollution) Act.Water (Prevention and control of Pollution) Act.Wildlife Protection Act.Forest ConservationAct. 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: HumanRights, Value Education, HIV/AIDS. Women and Child Welfare.Role of Information Technologyin 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 waterpollution, 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 disastermanagement framework; financial arrangements; role of NGOs, community –based organizationsand 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.

References:

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,Kalyani Publishers, New Delhi.
3. Odum E.P. and Barrett G.W.(2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Dhaliwal G.S., and D.S.Kley (2006) Principles of Agricultural Ecology. Himalyan Publishing house, Bombay
5. Brij Gopal, and N.Bhardwaj (2004) Elements of Ecology. Vikash Publishing House, Pvt. Ltd., New Delhi.
6. Mishra, P.C.(2001). Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi- 110026.
7. Pathak, H.and Kumar, S.(2003). Soil and Green House Effect, CBS Publishers and Distributors, 4596/1-A, 11, Dayaganj, New Delhi – 10002002E

Course Outcomes

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

CO1 Undersatnd and evaluate the basic environmental concepts, methods and scopes. And to prepare students for analyzes environmental issues.

CO2 Create and apply applications of environmental problem solving.

CO3 Understand the basic concepts of pollution and waste management processes and evaluate their management.

CO4 Create and apply pollution control methods for socity.

CO5 Understand the ecological balance and apply methods for disaster management.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L2,L5,	H	L	M	H	-	H	L	M	L	H	L	-	M	L
CO2	L3,L6	H	M	-	-	-	M	L	H	H	M	-	H	L	H
CO3	L2,L5	H	L	M	H	-	H	L	L	M	H	M	L	M	-
CO4	L3,L6	-	M	L	H	M	M	M	H	M	H	L	M	M	M
CO5	L2,L3	H	M	-	-	-	M	L	M	L	M	M	H	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO4

AG 308	Statistical Methods	2(1+1)

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 Representationof Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition andMultiplication Theorem (without proof).

UNIT-B Simple Problems Based on Probability. Binomial &Poisson Distributions, Definition of Correlation, Scatter Diagram.Karl Pearson's Coefficient ofCorrelation.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 ContingencyTable.

UNIT-D Introduction to Analysis of Variance, Analysis of One Way Classification.

UNIT-E Introduction toSampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with andwithout 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 (UngroupedData).Moments, Measures of Skewness & Kurtosis (Grouped Data).Correlation & RegressionAnalysis.Application of One Sample t-test.Application of Two Sample Fisher's t-test.Chi-Squaretest of Goodness of Fit.Chi-Square test of Independence of Attributes for 2 ×2 contingencytable.Analysis of Variance One Way Classification.Analysis of Variance Two Way Classification.Selection of random sample using Simple Random Sampling.

Course Outcome :

CO1 Acquaintance with some basic concepts in statistics.

CO2 Making familiar with some elementary statistical methods of analysis of data viz. measures of central tendency, dispersion, moments, skewness, and kurtosis and to interpret them.

CO3 Analysis of data pertaining to attributes and to interpret the results.

CO4 Study and implementation of sampling theory to make decesions.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,L2, L3	H	L	M	H	H	M	M	M	-	M	H	M	-	L
CO2	L2, L6	M	M	H	H	L	L	-	-	L	M	-	-	L	-
CO3	L1, L3	H	L	H	M	M	L	L	L	-	L	L	M	-	M
CO4	L3, L6	M	M	H	M	L	M	M	M	M	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO4

AG 309	Livestock and Poultry Management	4(3+1)

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, 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.

Refrences:

1. Banerjee, G.C. 2013. A Taxe 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. New India Pub Agency.
5. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management. Kalyani

Course Outcome:

At the end of the course, a student will be able to understand –

CO-1 Develop and evaluate animal production and management systems by integrating knowledge of animal genetics, nutrition and reproduction.

CO-2 Locate, critically evaluate, and apply information from scholarly animal science literature and other sources to expand personal understanding and knowledge of animal sciences, providing a foundation for lifelong learning.

CO-3 Create and interpret graphs, tables and diagrams illustrating scientific data and understand basic concepts relating to the design and analysis of research in the animal sciences.

CO-4 The application of scientific principles to animal breeding, reproduction, feeding, growth and development, health management, housing, and handling.

CO-5 Judging of animal and poultry and formulation of concentrate mixtures.

CO-6 This course imparts knowledge of external body parts and practice of handling restraining and identification of farm animals and poultry.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Pos/COs / **Blooms Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO_1 L1, L5, L6	M	M	-	L	L	-	-	-	H	M	M	H	M	M
CO_2 L1, L3, L4,	H	H	H	-	L	H	-	-	-	H	-	L	-	L
CO_3 L2, L3,L5,	-	H	H	H	H	M	-	-	-	L	L	-	L	-
CO_4 L3	H	-	M	H	L	M	H	-	H	H	-	M	M	M
CO_5 L5, L6	H	L	-	H	H	-	-	-	L	H	-	H	L	M
CO_6 L1, L6	H	H	-	L	H	H	M	L	M	-	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5, CO6
CD5	Industrial visit	CO5, CO6

AG-401	Crop Production Technology – II (*Rabi* crops)	3(2+1)

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 rabiseason 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 rabiforage 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 Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, 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 Rainfed Conditions. Kalyani Publishers, New Delhi.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.

Course Outcome

At the end of the course, a student will be able to

CO1: Know the Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabicrops .

CO2: Identify weeds in rabi season crops. For Examples Pulses-chickpea, lentil, peas; oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane, Medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

CO3: Know about irrigation scheduling in rabi crops, additional area can be increased of low water requiring crops.

CO4: Know about the economic importance of medicinal and Aromatic crops in present sphere.

CO5: Visit and demonstrate research stations of related crops.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L1	H	L	M	-	M	-	M	M	-	M	L	-	H	H
CO2	L1,	H	-	-	M	L	M	-	M	M	H	-	M	H	H
CO3	L1	H	M	M	M	L	M	L	M	H	M	-	H	M	M
CO4	L1,	H	L	L	M	-	M	L	M	M	H	M	H	H	L
CO5	L3	H	-	L	H	-	H	M	H	H	M	M	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

AG-402	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)

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, lilium and orchids under protected conditionsand gladiolus, tuberose, chrysanthemum under open conditions.

UNIT-C Package of practices for looseflowers like marigold and jasmine under open conditions.Production technology of importantmedicinal plants like ashwagandha, asparagus, aloe, costus, cinnamomum, periwinkle, isabgol.

UNIT-D Aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, 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

1. Chada, K.L. (2002) Handbook of Horticulture, ICAR, New Delhi.
2. Neeraj Pratap Singh (2005) Basic concepts of Fruit Science, IBDC Publishers.
3. Fullagar, Richard, Judith Field, Tim Denham, and Carol Lentfer (2006) Early and mid Holocene tool-use and processing of taro (Colocasia esculenta), yam (Dioscorea sp.) and other plants at Kuk Swamp in the highlands of Papua New Guinea Journal of Archaeological Science 33: 595–614.
4. Jitendra Singh (2011) Basic Horticulture, Kalyani Publications, New Delhi.
5. Jules Janick. "History of Horticulture". Purdue University. Archived from original on September 10, 2012. Retrieved September 21, 2012.

Course Outcome-

At the end of course students will be able to

CO1: Know the importance of ornamental, medicinal and aromatic crops.

CO2: Understand and adapt the scientific cultivation methods of different ornamentals crops like Rose, Gaillardia, Gladiolus, Tuberose and Chrysanthemum.

CO3: Understand and create the scientific cultivation methods of medicinal crops like ashwagandha, senna, isabgol and goggle.

CO4: Know and classify more about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield.

CO5: Identify and experiment the aromatic and know about landscaping and its features.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	L	H	L	H	H	M	H	H	H	L	M	L	-
CO2	L2, L3	H	M	M	H	M	M	M	M	M	M	-	M	M	-
CO3	L2,L6	M	H	H	-	H	-	M	L	H	M	L	-	M	-
CO4	L1, L4	H	M	-	-	H	H	-	-	H	H	-	H	L	L
CO5	L1, L3	H	L	M	M	-	-	M	-	-	M	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and COs

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO4 , CO5
CD5	Industrial visit / Field visit	CO5

AG 403	Renewable Energy and Green Technology	2(1+1)

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.

References-

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.

Course Outcome-

At the end of course students will be able to

CO1: Know the concept and the role of renewable sources in agriculture sector.
CO2: Describe and understand the bio fuel production and their applications in today's world.
CO3: Demonstrate and understand and utilizing the solar energy in various aspects.
CO4: Discuss about all the solar gadgets and biogas plant, wind energy, conventional and non-conventional energy.
CO5: Compose a solar energy system for future opportunity and examine solar photovoltaic system: solar light, solar pumping.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	M	H	M	L	M	M	M	H	H	H	M	L	M	-
CO2	L2	M	M	M	H	H	L	M	L	L	H	H	L	L	L
CO3	L1, L3	H	H	M	M	H	M	L	M	L	H	M	M	-	M
CO4	L2	M	H	M	M	H	M	L	M	L	H	L	L	L	L
CO5	L4, L6	M	M	M	H	H	M	L	M	M	M	L	L	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4,CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4 , CO5
CD5	Industrial visit / Field visit	CO4 , CO5

AG-404	Problematic soils and their management	2(2+0)

Course objective:

- To know distribution of problem soils in different agro climatic zones in India.
- To find out various problems in Saline , sodic , Acidic, Flooded andCompact soil .
- Management of various promblmatic soil
- Quality, standards and utilization of saline water in agriculture.

Theory

UNIT-A Soil quality and health, Distribution of Waste land and problem soils in India. Theircategorization based on properties. Reclamation and management of Saline and sodic soils, Acidsoils, 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, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

References:

1. Bear FE. 1964. Chemistry of the Soil. Oxford & IBH.
2. Jurinak JJ. 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 Dhurvanarayana, 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.

Course outcome

At the end of this course students will be able to

CO 1: To examine soils health.

CO 2: To understand severity of Salinity, Alkalnity, Acidity, flooded and Compactness of soil.

CO 3: Management practices to improve physical and chemical properties of problematic soil.

CO 4: Soil Survey through Remote Sensing and GIS techniques.

CO 5: Utilization of Land through Land capability and suitability class.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	L4	H	M	M	L	H	M	-	-	L	H	M	H	H	H
CO 2	L2	H	H	M	-	L	-	H	-	-	H	-	-	M	L
CO 3	L1,L2	M	-	M	-	-	-	M	-	-	L	M	H	H	M
CO 4	L4	M	M	H	M	L	H	H	M	H	M	M	M	M	M
CO 5	L2,L6	M	M	L	-	H	M		-	-	M	-	-	M	M

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3,
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2
CD5	Industrial visit	CO1, CO4

AG-405	Production Technology for Fruit and Plantation Crops	2(1+1)

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 bio regulators and their uses, important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

Reference:

1. Bal, J.S., (2010). Fruit Growing Kalyani Publishers, New Delhi.
2. Banday F.A. and Sharma M.K., (2010). Advances in Temperate Fruit Production Kalyani Publishers, New Delhi
3. Bose, T.K., Mitra, S.K. and Sanyal, D., (2002). Tropical and Sub-Tropical-Vol-I, Nayaprakash, Kolkata
4. Chadha, T.R, (2001). Text Book of Temperate Fruits, ICAR Publication.
5. Chattopadhyay T.K., (2009), A text book on Pomology-IV Devoted to Temperate fruits, Kalyani Publishers, New Delhi.
6. K.L.Chadda, (2009), Advanced in Horticulture, Malhotra Publishing House, New Delhi.

Course Outcome:

At the end of this course students will be able to

CO1: Know the importance of different fruit crops and plantation crops.

CO2: Discuss and identify the fruit and plantation crops.

CO3: Describe package of practices and its use for the major crops like mango, banana, guava, lemon, pineapple, coffee, coconut and rubber.

CO4: Describethe concept of high density planting in different fruit crops to improve the yield per unit area

CO5: Define and enlist bio-regulators and their uses.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,L4	H	L	H	H	M	L	L	M	L	M	-	-	M	M
CO2	L2	M	H	H	M	L	L	M	L	L	H	L	L	L	-
CO3	L2,L3	H	H	H	H	H	M	L	M	H	M	M	M	L	-
CO4	L1,L6	M	M	H	M	H	M	L	M	L	L	L	M	L	-
CO5	L1,L3	H	L	M	H	L	L	L	L	M	M	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2
CD5	Industrial visit	CO3, CO4

AG-406	Principles of Seed Technology	3(1+2)

Course objectives:

- To know the maintinance 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 causesof crop varieties and their control; Maintenance of genetic purity during seed production, seedquality; Definition, Characters of good quality seed, different classes of seed.

UNIT-B Foundation andcertified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seedcertification, phases of certification, procedure for seed certification, field inspection. Seed Act andSeed Act enforcement. Duty and powers of seed inspector, offences and penalties.

UNIT-C Seeds ControlOrder 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular andBiochemical test. Detection of genetically modified crops, Transgene contamination in non-GMcrops, 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, stagesand factors affecting seed longevity during storage. Measures for pest and disease control duringstorage.

UNIT-E Seed marketing: structure and organization, sales generation activities, promotionalmedia. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private andpublic sectors and their production and marketing strategies.

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 plant.

References:

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. DhirenraKhare 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. BeezSansadhan, GBPA&T, Pantnagar.
8. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

Course Outcomes:-

At the end of this course students will be able to

CO1 Know the seed production program for full fill the requirement of quality seed in market and increase the farm income.

CO2 Understand the storage methods of pure variety seed to solve the availability crises of pure variety seed due to adverse environmental conditions.

CO3 Produce and distribute the disease free seed in the market to get the environment friendly cultivation of crops.

CO4 Understand the seed quality to increase the farm income by producing high yielding, disease free quality seed and decrease the cost of cultivation also.

CO5 Know the hybrid seed production program of different crops to increase the farm income.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	L1	H	L	L	H	L	-	L	-	M	L	L	L	M	-
CO 2	L2, L3 L4	M	M	-	L	L	M	-	L	L	L	L	-	M	M
CO 3	L3	H	L	M	H	H	L	L	L	M	-	M	M	H	L
CO 4	L2,L3	M	M	M	L	L	M	M	L	L	M	L	M	L	H
CO 5	L3,L4	H	L	L	M	H	L	M	M	-	L	-	L	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO4, CO5

AG 407	Farming System & Sustainable Agriculture	1(1+0)

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 system, 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.

Course Outcome

At the end of this course students will be able to

CO1 Know the major problems in Indian agriculture and summarize farming system components.

CO2 Evaluate the different cropping system.

CO3 Explain about sustainable agriculture and recommend use of low external inputs in agriculture.

CO4 Determine the different agricultural allied enterprises in India.

CO5 Formulate different farming system according to climatic conditions and demonstrate integrated farming system model.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/Cos	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L2	H	L	H	-	M	-	M	M	H	M	-	-	H	L
CO2	L5	H	M	M	-	H	-	L	M	H	M	-	-	H	M
CO3	L2, L5	H	H	M	-	H	-	H	H	H	H	-	M	H	H
CO4	L5	H	L	M	-	H	-	L	H	M	H	-	H	H	L
CO5	L6	M	M	H	H	M	-	H	M	M	M	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial Visit / Field Visit	CO1, CO2, CO5

AG 408	Agricultural Marketing, Trade & Prices	3(2+1)

Course Objective:

- To imparting knowledge of agriculture marketing, different systems, price analysis and trades, financepolicy 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 sectionsof 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 labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agriculturalmarketing; 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 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 commodity, 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.

Reference:

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 outcome:

At the end of the course, a student will be able to understand –

CO-1 Able to observe the Optimization of Resource use and Output Management: An efficient agriculturalmarketing system leads to the optimization of resource use and output management. An efficient marketing system can also contribute to an increase in the marketable surplus by scaling down the losses arising out of inefficient processing, storage and transportation. A well-designed system of marketing can effectively distribute the available stock of modern inputs, and thereby sustain a faster rate of growth in the agricultural sector.

CO-2 Able to explain how to increase the Farm Income: An efficient marketing system ensures higher levels of income for the farmers by reducing the number of middlemen or by restricting the commission on marketing services and the malpractices adopted by them in the marketing of farm products.

CO-3 Able to know the Growth of Agro-based Industries: An improved and efficient system of agricultural marketing helps in the growth of agro-based industries and stimulates the overall development process of the economy. Many industries depend on agriculture for the supply of raw materials.

CO-4 Able to adapt and Spread of New Technology: The marketing system helps the farmers in the adoption of new scientific and technical knowledge. New technology requires higher investment and farmers would invest only if they are assured of market clearance.

CO-5 Able to know the Addition to National Income: Marketing activities add value to the product thereby increasing the nation's gross national product and net national product.

CO-6 Able to identify the career opportunities in the agriculture industry as well as emerging trends.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2,L6, L5	H	L	-	M	L	H	-	-	L	L	L	H	H	H
CO2	L3,l2	H	-	L	M	-	H	L	L	-	M	-	H	M	-
CO3	L1,l6	H	-	L	M	L	H	L	L	-	L	M	H	-	M
CO4	L3	H	M	L	M	L	H	M	M	-	L	L	M	M	M
CO5	L1	M	-	M	M	L	M	L	M	-	M	-	H	-	L
CO6	L2	H	-	H	H	M	H	M	M	-	L	L	H	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4, CO6
CD4	Self- learning advice using internets	CO6, CO5
CD5	Industrial visit	CO4

AG 409	Introductory Agro meteorology & Climate Change	2(1+1)

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, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking.

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

Course Outcomes:

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

CO 1. Understand the role of agrometeorology in agriculture and its relation to other areas of agriculture to acquaint with recent developments in Agrometeorology.

CO 2. Know about relationship of climate with agriculture science.

CO 3. Calculate the different weather parameters.

CO 4. Utilize various types of weather forecast and seasonal climate forecast to develop weather based agro advisories for sustaining the crop production.

CO 5. Understand the basic fundamentals of Agro meteorological Observatory, exposure of instruments and weather data recording.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,L2	H	M	-	-	L	L	M	L	H	M	-	-	H	M
CO2	L4	M	M	H	L	L	-	M	L	H	M	-	-	M	H
CO3	L2,L3	H	M	M	M	M	M	M	-	H	M	-	-	M	H
CO4	L5	H	M	M	M	L	M	M	M	M	H	L	M	H	M
CO5	L2	M	H	L	-	L	H	M	L	H	M	-	M	L	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4 , CO5

AG 410 A	Protected Cultivation	2(1+1)

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:

Mulching - Surface covered cultivation – plastics mulching – code of practice.Greenhouse - Plastic film for Greenhouses - Recommendations for Layout, Design and Construction of Greenhouse Structures . Recommendations for Heating, Ventilating and cooling of Greenhouses Steel Tubes for Structural Purpose.Agro Shade nets for Agriculture & Horticulture Purpose

Protection Nets Plant. Vermi-Bed Agro Textiles- High Density Polyethylene (HDPE) Woven Beds For Vermi- culture Specification.

References:

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic 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 Willy and Sons, New York.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

Course Outcome:

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

CO1 Adapt green house technology, its type and construction process.

CO2 Understand the machanism of Green house equipments, and its Irrigation System.

CO3 Choose Agro shade nets for Horticulture purpose.

CO4 Know the concept of Plant protection nets.

CO5 Apply the concept of vermiculture preparation.

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	L	-	M	H	L	L	-	M	H	H	L	H	H	M
CO2	L2	H	M	L	-	M	H	L	L	-	L	M	L	H	H
CO3	L1	L	M	-	H	L	H	M	H	M	-	M	L	M	H
CO4	L1	H	-	L	M	H	L	H	M	-	L	H	H	-	M
CO5	L3	L	-	H	L	M	H	L	-	L	M	H	M	L	-

H- High, M- Modera te, L- Low "-" for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO5

AG 410B	AGRIBUSINESS MANAGEMENT	3(2+1)

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, polices 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 behavior 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, 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 agriculturalcommodities. Net present worthtechnique for selection of viableproject.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

Course outcome:

CO1- Know the fundamental marketing principles, role of marketing, marketing mix and observe the marketing problems dealt with by managers.

CO2 - Recognize the various marketing channels and areas and means to develop business ventures

CO3 - Assemble knowledge about organization and functioning of different institutions involved in agriculture marketing

CO4 - Evaluate the project feasibility and encourage them to start new ventures.

CO5 - Evaluate the Co-operatives in Agricultural Marketing.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,L2	H	M	H	L	H	-	L	H	-	H	M	M	-	L
CO2	L6,L2	H	M	M	-	M	L	M	M	H	M	L	M	-	M
CO3	L6	M	H	H	-	H	-	M	L	H	M	L	-	-	-
CO4	L5	H	M	-	-	H	H	-	-	H	H	-	H	L	M
CO5	L5	H	-	-	M	-	-	M	-	-	M	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4

AG 410C	Agrochemicals (Elective Course)	3 (2+1)

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 potassiumchloride, 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 kin market.Estimation of nitrogen in

Urea.Estimation of water soluble P2O5 and citrate soluble P2O5 in single super phosphate.Estimation of potassium in Muraite 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.

References:

1. Shalini Suri, Biofertilizers and Biopesticides, 2011. APH Publishing Corporation.
2. Arun. K. Sharma. 2011. Handbook of Organic farming. Agrobios (India), Jodhpur.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.

Course outcome:

At the end of this course students will be able to

CO1 Describe the agro-chemicals and their effect on environment, soil, human and animal health.

CO2 Demonstration of pesticides application technology and study about various pesticides appliances.

CO3 Discuss the role of agro-chemical in quality parameters of various agricultural products and key role of bio-fertilizer in maintain soil health.

CO4 Determination of N, P_2O_5 and K in Urea, SSP and Muraite of Potash.

CO5 Formulation of different insecticide, fungicide, fertilizers and complex fertilizers.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/Cos	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	-	-	M	H	-	H	-	H	H	M	-	M	H
CO2	L3	H	L	H	H	M	-	M	H	-	H	-	H	H	H
CO3	L1, L2	H	M	M	-	-	M	H	-	M	M	L	M	H	-
CO4	L5	M	H	-	-	M	-	H	H	M	H	-	H	M	L
CO5	L6	H	-	H	H	H	H	H	-	H	H	-	H	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO3
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO2, CO5

AG 410D	Commercial Plant Breeding (Elective Course)	3 (2+1)

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.

Reference:

1. Alard, R.W. 2000.Principles of Plant Breeding. John Willey & 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.

Course Outcomes:

CO-1 Apply the plant breeding method to develop resistant and high nutritive varieties.

CO-2 Identification and evaluation of crop genotype to improve the crops.

CO-3 Know the gene preservation method for further use for improving Rabi varieties.

CO-4 Identification and evaluation of resistance gene, related to Rabi crop with high yield potential against Pest and pathogen.

CO-5 Know hybrid seed production methods for increase the crop yield.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/Cos	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3L6	H	-	-	M	-	-	L	-	M	-	M	L	H	L
CO2	L4,L5	M	L	-	M	L	M	-	-	L	M	M	-	M	-
CO3	L1	H	-	M	L	H	L	L	M	M	-	-	M	H	L
CO4	L4,L5	H	L	L	L	L	L	-	L	L	L	M	L	M	L
CO5	L1	M	-	L	M	H	-	-	-	-	L	-	M	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO3
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO2, CO5

AG 501	Principles of Integrated Pest and Disease Management	2(1+1)

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

Course Outcome:

At the end of this course students will be able to

CO1 Identify and analysis the sign and symptoms for detection of pathogens and Pest.

CO2 Apply integrated methods of disease and pest management.

CO3 Design IPM Modules and check the validation of the Modules

CO4 Demonstrate IDM and IPM modules of wheat, rice, groundnut, mustard potato,cumin,citrus and chickpea diseases.

CO5 Formulate Trichoderma, NPV, *Pseudomonasetc*

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Level of Taxonomy	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2,L4	H	H	H	H	H	-	M	-	-	H	-	-	L	-
CO2	L3	H	H		H	H	-	L	M	H	H	M	M	M	-
CO3	L6,L4	H	H	H	M	H	-	-	M	H	H	H	-	L	L
CO4	L3	H	H	H	M	H	M	-	L	H	H	-	M	M	M
CO5	L1,L6	H	H	H	H	-	M	-	-	H	H	H	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Method

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO1, CO2, CO3,
CD3	Seminars	CO2, CO3,
CD4	Self- learning advice using internets	CO1,

CD5	Industrial visit / Field visit	CO4, CO5

AG-502	**Manures Fertilizers and fertility Management**	**3(2+1)**

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, nanofertilizers 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, factors affecting nutrient availability to plants.

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

UNIT-E Critical levels of different nutrients in 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. Rai, M.M. (2002) Principal of Soil Science,Mac Millan India Ltd, New Delhi
2. Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi

3. ISSS (2002) Fundamental of Soil Science Div. of Soil Science,IARI, New Delhi

4. Singh Dhyan, Chhonkar,P.K. and Dwivedi V.S. (2005) Manul on Soil Plant and water analysis. Westville Publishing House,New Delhi

5. Singh Vinay (1996) (Hindi) Soil Science,fertilizer& Manures ,V.K. PrakashanBarotMerrut (U.P)

6. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. Agriculture-Horticulture Publishing House, Nagpur.

7. Sanchalli, V.K. (1960). Chemistry and Technology of Fertilizers. Reinheblpublishingcorporation, New York,USA.

8. Chopra, S.L. and Kanwar, J.S. (1991). Analytical Agriculture, Chemistry, Kalyani Publishers, New Delhi.

9. Tandon, H.L.S. (1989). Soil water and fertilizers analysis, Fertilizer Development and Consultant organization, New Delhi

Course outcome

At the end of this course students will be able to

CO 1: Demonstrate importance of organic manures and its methods of preparation.

CO 2: Classify major nitrogenous, phosphatic, potassic, secondary and micronutrient fertilizers.

CO 3: Learn fertilizer storage techniques and apply fertilizer control order.

CO 4: Student will understand the criteria of essentiality, role, deficiency and toxicity symptoms of essential plant nutrients.

CO 5: Describe method of fertilizer recommendations to crops.

CO 6: Student can determine fertility status of soil.

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Level of Taxonomy	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L 3	H	H		M	L	M	H	M	L	H	L	L	L	L
CO2	L2,L4	H	H	M	M	-	L	H	-	-	H	-	H	L	L
CO3	L1,L3	H	-	M	M	-	-	M	-	-	H	-	-	M	L
CO4	L1,L2	H	-	M	M	L	-	H	M	H	H	L	L	M	M
CO5	,L1	H	M	L	H	H	M	-	-	-	H	L	H	L	M
CO6	L1,L5	H	M	-	M	H	L	-	-	M	M	L	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4 , CO5
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO3, CO4, CO5

AG-503	Pests of Crops and Stored Grains and Their Management	3(2+1)

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 on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of 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 seasonalhistory of various insect pests attacking crops and their produce: (a) Field Crops; (b) VegetableCrops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identificationof insect pests and Mites associated with stored grain. Determination of insect infestation bydifferent methods.Assessment of losses due to insects.Calculations on the doses of insecticidesapplication technique.Fumigation of grain store / godown.Identification of rodents and rodentcontrol 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.

Reference:

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.

Course Outcome:

At the end of this course students will be able to

CO1: Identification of different insect pest of field, horticulture, ornamentals, vegetables and stored grains illustrate at the field level.

CO 2: Describe how insects affect animal, Plant health and agricultural production and safely manipulate populations of beneficial and destructive species below ETL.

CO 3: Explain the biology, diversity, distribution and survey of insect-pest and their relationships to crop and the environment condition of a particular area.

CO 4: Understand the nature of damage and symptoms caused by the pest and able to apply suitable technique of pest management.

CO 5: Recommend the situable approach of Integrated Pest Management without side effect on plant, animal and environment health.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2, L3	H	L	-	-	H	-	M	L	H	H	-	-	H	-
CO2	L1, L2	H	M	L	-	M	-	M	-	M	H	-	-	M	-
CO3	L2	M	H	-	-	H	-	H	M	H	H	-	L	M	L
CO4	L2, L3	H	H	H	M	H	H	H	-	H	H	L	H	L	H
CO5	L5	M	M	H	H	M	H	H	-	H	M	H	H	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4 , CO5
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO3, CO4, CO5

AG 504	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)

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: Phytophthorablight;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 andblack 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 wellmounted specimens.

References:

1. Cook, AA. 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.
8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Singh, R.S.1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Course Outcome

At the end of this course students will be able to

CO1 To know the common pathogens of different kharif diseases.
CO2 To acquire the knowledge about etiology, and symptoms of diseases in kharif Plants
CO3 To Trace the diseases Cycle of different Pathogens in Kharif Season.
CO4 To learn utilizing different control methods for different diseases.
CO5 To identify the diseases of various diseases in field and Culture In the lab
CO6 Student will learn collection method in field and Peserving Method of diseases sample in lab

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,	H	H	-	-	-	-	H	-	-	H	-	-	M	H
CO2	L1	H	H	M			-	H	-	-	H	-	-	L	M
CO3	L3	H	H	M	H	-	-	H	-	L	H	-	-	H	-
CO4	L1	H	H	H	M	H	H	-	M	H	H	M	M	M	M
CO5	L2,L4	H	H	H	M	H	M	-	-	-	H	L	L	-	-
CO6	L1,L3	M	H	H	M	M	H	-	-	-	H	L	L	-	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD1	Lectures by use of board/LCD/	CO1,CO2,CO3,CO4
CD2	Tutorial/Assgnments	CO1, CO2,CO3,CO4
CD3	Seminar	CO2,CO3,CO4
CD4	Self learning	CO1,CO2,CO4
CD5	Field Visit	CO5,CO6

AG-505	Crop Improvement-I (*Kharif* crops)	2(1+1)

Course objectives

- To provide training of breeding methods in field.
- To creates abilities to evaluate resistant varieties with breeding practices on the field.
- To provide field training for observe and classify the field crop on 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, itsutilization and conservation, study of genetics of qualitative and quantitative characters;

UNIT-C Importantconcepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Majorbreeding objectives and procedures including conventional and modern innovative approachesfor development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stressitolerance and quality (physical, chemical, nutritional);

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

UNIT-E Ideotype concept and climate resilientcrop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame , Castor, Cotton, Cowpea, Pearl millet and Tobacco. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent 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.

References:

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, AK., 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 Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co..INC, East Port, Conneacticut, 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.

Course Outcomes:

At the end of this course students will be able to

CO1: Understand the importance of wild relative and utilize them to produce new varieties of kharif crop.

CO2: Knowledge of gene preservation method for further use to improve kharif crops.

CO3: Apply the breeding method to improve and develop the kharif crops.

CO4: Identify and evaluate of resistance gene relate to kharif crop with high yield potential against Pest and pathogen and utilization of genetic informations.

CO5: Understand the new genetic approaches to achieve a definite ideotype of khaif crop.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2, L4, L3	M	L	-	M	L	L	M	L	M	L	L	L	M	L
CO2	L1, L3, L6	M	M	L	L	L	M	L	L	M	H	L	L	M	M
CO3	L3, L6	H	L	M	M	M	L	L	L	M	L	M	M	L	L
CO4	L4, L5	H	-	L	L	H	L	-	L	L	M	M	L	-	M
CO5	L2	M	L	M	M	H	-	L	M	L	L	H	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,CO5
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	CO4, CO5

AG 506	Entrepreneurship Development and Business Communication	2 (1+1)

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 skill, 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.

References:

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. Mukesh Pandey & Deepali Tewari. 2010. *The Agribusiness Book.* IBDC Publishers.
8. Nandan H. 2011. *Fundamentals of Entrepreneurship.* PHI Learning Pvt Ltd India.

Course Outcomes:

At the end of the course, student will be able to–

CO1 Understand the concepts of entrepreneurship.

CO2 Describe the role and importance of enterpreneurship.

CO3 Relate different skills for entrepreneurship development.

CO4 Understand and apply the concept of supply chain management and total quality management to agri entrepreneurship.

CO5 Demonstrate the process of project planning and formulation.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	-	M	H	-	H	-	H	M	H	M	M
CO2	L2	M	H	M	L	-	M	L	-	L	M	H	H	M	M
CO3	L4	L	M	L	-	H	-	H	L	M	-	L	L	-	M
CO4	L3,L1	H	L	-	H	L	M	-	L	H	-	M	M	L	L
CO5	L3	L	M	M	-	-	H	L	M	L	M	-	H	M	M

H- High, M- Moderate, L- Low "-" for no correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO3
CD3	Seminars	CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial Visit / Field Visit	CD3, CD5

AG-507	Geoinformatics and Nanotechnology and Precision Farming	2(1+1)

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 Indianagriculture; Geo-informatics- definition, concepts, tool and techniques; their use in PrecisionAgriculture.

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

UNIT-C Spatial data and their management in GIS; Remote sensing conceptsand 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 foroptimization 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. McGrew 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

Course Outcomes

At the end of the course, a student will be able to–

CO1: Know about precision agriculture and its relation between economical and environmental issues that affects the productivity of agriculture.

CO2: Show how employer characteristics and decision-making at various levels enhance the success of an agricultural enterprise.

CO3: Understand the consequences of applying imbalanced doses of farm inputs like irrigation, fertilizers, insecticides and pesticides.

CO4: Encourage the farmers to study of spatial and temporal variability of the input parameters using primary data and all calculations at field.

CO5: Evaluate the impact of globalization and diversity in modern agriculture.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	LI,L4	H	M	-	-	L	L	M	L	M	M	-	-	L	-
CO2	L3	H	M	L	-	L	-	L	M	-	M	M	M	-	M
CO3	L2,L4	M	L	L	-	-	H	M	-	L	M	M	L	-	-
CO4	L3,L2	H	L	M	L	M	M	M	M	L	M	L	M	-	-
CO5	L5	H	M	H	M	M	H	L	M	H	M	-	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	CO5

AG-508	Practical Crop Production – I (*Kharif* crops)	2(0+2)

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, 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 AgronomyAgrobios (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.

Course Outcome

At the end of the course, a student will be able to–

CO1:- Knowledge to plan for profitable crop production.

CO2: - Practical knowledge of remunerative crop production techniques.

CO3:- Understand thecropping sequence followed under the prevailing climatic conditions and available resources for sustainable agriculture.

CO4:- Calculate the cost of cultivation, B: C ratio and net return

CO5:- Prepared of balance sheet including cost of cultivation, net returns

Mapping between Programme Outcomes (Pos) and Course Outcomes (Cos)

Course outcome	Blooms level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L 6, L1	H	H	M	H	M	H	L	H	L	M	M	H	M	H
CO2	L 3	H	H	H	H	M	M	L	H	L	L	-	M	H	H
CO3	L 4	H	M	H	L	H	H	L	-	H	M	L	-	M	H
CO4	L 5,4	-	H	M	H	L	-	L	L	L	M	-	L	H	M
CO5	L6	L	M	H	-	M	L	-	-	-	M	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO3
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial visit	-

AG 509	Intellectual Property Rights	1(1+0)

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, TRIPsand 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, filingof 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 foodand agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, accessand benefit sharing.

Reference books:

1. Erbisch, F.H. and K. Maredia. Intellectual Property Rights in Agricultural Biotechnology. Wallingford: CABI, 1998.
2. Ganguli, Prabudha. Intellectual Property Rights: Unleashing knowledge economy,-New Delhi, McGraw-Hill, 2001

3. India, Ministry of Agriculture. State of Indian farmer. Vol. 5 Technology generation and IPR issues, New Delhi, Academic Foundation, 2004

4. Intellectual Property Rights: Key to new wealth generation,-Delhi NRDC and Aesthetic Technologies, 2001

5. Rothschild, Max and Newman, Scott, Ed. Intellectual Property Rights in Animal Breeding and Genetics. Wallingford: CABI, 2003.

6. Saha, R, ed. Intellectual Property Rights in NAM and other developing countries: A Compendium on law and policies,- Delhi: Daya, 2006.

7. Santaniello, V., R.E. Evension, D. Zeberman, and G.A. Carlson, Eds. Agriculture and Intellectual Property Rights: Economic, institutional and implementation issues in Biotechnology- Hyderabad, University Press, 2003.

Course Outcomes:

At the end of this course Students will be able to

CO1: Describe the concept of intellectual property rights.

CO2: Procedural knowledge to legal system and solving the problem relating to intellectual property rights.

CO3: Discuss the professional programs in company secretary ship, law, business, agriculture, international affairs, public administration and other fields.

CO4: Understand the working nature of compliance officer, public relation officer, liaison officer etc.

CO5: Explain the establishment of legal consultancy and service provider.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Blooms level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	M	H	-	M	-	L	M	-	H	-	L	M	L
CO2	L1	M	H	M	-	H	-	M	H	-	M	-	M	-	M
CO3	L2	M	H	H	L	M	H	H	M	-	H	-	H	L	M
CO4	L2	M	H	M	-	M	M	M	L	-	H	-	H	-	-
CO5	L2, L3	-	M	M	-	L	M	H	-	-	H	-	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO4

AG 510A	Agricultural Journalism (Elective Course)	3 (2+ 1)

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, 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 from wire services. Writing different types of agricultural stories.Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

References:

1. Bhaskaran, C, Prakash, R. & Kishore Kumar, N. 2008. Farm Journalism in Media Management. Agro-Tech. Publishing Academy.
2. Chattergee, 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. Goyalsaab 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. Biswasroy (Ed.). Kanishka Publication.

11. Shrivastava, K.M. 1995. News Writing for Radio and TV. Sterling Publication.

12. Sinha, K.K. 2001. Business Communications. Galgotia Publication.

Course Outcomes:

At the end of the course, a student will be able to–

CO1 Know about basics of agricultural journalism.

CO2 Understand the difference between different types of journalism.

CO3 Apply their knowledge in communication media.

CO4 Improve readability measures.

CO5 Develop better sources of agriculture information.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	M	M	H	L	M	-	L	H	-	H	M	-	H	M
CO2	L2	H	M	M	L	-	L	L	H	-	M	M	-	M	H
CO3	L3, L1	M	M	H	-	-	-	L	H	-	M	M	H	H	L
CO4	L6	H	M	-	-	M	L		M	M	H	-	M	-	M
CO5	L6	H	-	-	M	M	-	M	M	M	M	M	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4.CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO2

AG 510B	Landscaping (Elective Course)	3 (2 + 1)

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 station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.

UNIT-E Bonsai: principles and management, lawn: establishment and maintenance. CAD application.ort of the ICAR Fifth

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.

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.

Course outcome:

At the end of course students will be able to

CO1: Identify metrological instruments and understand the diversity within the profession of Floriculture following safety precautions.

CO2: Identify the Plant morphology, different plant varieties and plant families.

CO3: Identify and select different propagation methods, Handling of seed, bulbs, cut flowers, Nursery plants, pot plants.

CO4: Plan and execute Survey for landscaping and various types of indoor gardening.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	M	H	-	H	-	H	H	M	-	M	M
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	-	H
CO3	L1, L2	M	H	M	-	-	M	H	H	M	M	-	M	M	M
CO4	L4, L6	H	H	-	H	M	-	H	-	M	H	-	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

AG 510C	Food Safety and Standards (Elective Course)	3 (2 + 1)

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, FSSA.Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling.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 physico-chemical 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.

References:

1. Fortin, Neal D. (2017). Food Regulation: Law, Science, Policy, and Practice (2nd ed.). Hoboken, New Jersey: John Wiley Sons , Inc. ISBN 9781118964477. LCCN 2016031565. OCLC 976412308. Retrieved 18 June 2017.
2. Satin, Morton (2008). Food alert!: the ultimate sourcebook for food safety (2nd ed.). New York, NY: Facts On File. ISBN 9780816069682.
3. Clute, Mark (October 2008). Food Industry Quality Control Systems. CRC Press. ISBN 978-0-8493-8028-0.
4. Comprehensive Reviews in Food Science and Food Safety, ISSN 1541-4337 (electronic) ISSN 1541-4337 (paper), Blackwell Publishing.

Course Outcomes

At the end of course students will be able to

CO1 Describe Initiative from Government for organic produce.

CO2 Illustrate Role of NGOs in producing organic products.

CO3 Examine of the Selection of crops and varieties for organic produce

CO4 Discuss about Recent concerns- New and Emerging Pathogens. and contract Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenic.Certification of organic produce.

CO5 Discuss and Demonstrate the Pest management by means of organic resources.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	L	M	L	M	M	L	M	L	L	M	H	H	L	M
CO2	L3	H	L	M	M	L	L	M	H	M	H	M	H	-	H
CO3	L4	M	L	M	M	M	M	L	L	M	L	H	H	M	M
CO4	L2	M	M	M	L	M	L	M	L	M	M	M	H	-	H
CO5	L2,L3	L	L	M	-	L	L	M	L	M	L	M	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

AG 510D	Bio-pesticides & Bio-fertilizers (Elective Course)	3 (2+ 1)

Course Objective:

- To know about history, concept, importance,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 limitation 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 ectomycorhiza. 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, Metarhyzium*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.

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.

Course Outcomes:

At the end of the course, Students will be able to understand:

CO1: To adaptation of bio-pesticides and Bio-fertilizers in place of chemical fertilizers for sustainable development of agriculture.

CO2: Description of mass production technique of bio-fertilizers and bio-pesticide in laboratory.

CO3: Survey for identification of bio-control agents present in field condition and in bio-pesticide laboratory.

CO4: Justify recommendation of bio-pesticide and bio-fertilizers to farmers for better pest control and maintain the soil health.

CO5: Observe the effect of bio-pesticide on pest population and bio-fertilizers on soil health.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	-	-	M	H	-	H	-	H	H	M	-	H	M
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	H	H
CO3	L1, L4	M	H	M	-	-	M	H	H	M	M	-	M	M	H
CO4	L5	H	H	-	H	M	-	H	-	M	H	-	H	H	H
CO5	L2	H	-	M	-	M	H	H	-	H	H	M	-	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO3

AG-601	Rainfed Agriculture & Watershed Management	2(1+1)

Course Objective

- To be acquainted with the meaning, concept and importance of Rainfed Agriculture and watershed management.
- To high light 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 pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on 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.

Course Outcomes:

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

CO1: Know the basic concepts and impact of rainfed agriculture.

CO2: Know the influence of rainfall and its pattern in crop production.

CO3: Learn about climate behavior with respect to agriculture.

CO4: Protect the crops under adverse condition of famine/draught situations.

CO5: Acquire the knowledge of various water harvesting devices i.e. Anicut Dams, khadin, farm pond, and water storage tanks etc.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	L	M	L	M	L	H	M	L	L	H	H
CO2	L1	M	M	L	-	L	L	M	L	H	M	-	L	M	H
CO3	L1,L2	H	L	M	-	L	M	M	L	H	-	-	M	M	H
CO4	L2,L3	M	M	L	L	-	-	L	-	H	M	L	-	H	M
CO5	L2	H	H	M	L	L	L	M	L	H	M	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Method

CD1	Lectures by use of board /LCD	CO2, CO3
CD2	Tutorial/ Assignments	CO1, CO4,CO5
CD3	Seminar	CO3,CO5
CD4	Self learning	CO2, CO3, CO5
CD5	Field Visit	CO2, CO4

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lectures by use of board/LCD	CO1,CO2,CO3,CO4
CD2	Tutorial/Assignments	CO2,CO3,CO4
CD3	Seminar	CO2,CO3,CO4
CD4	Self learning	CO1,CO2,CO4
CD5	Field Visit	CO3,CO5

AG 602	Protected Cultivation and Secondary Agriculture	2(1+1)

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 type of green houses based on shape. Determine the rate of air exchange inan active summer winter cooling system. Determination of drying rate of agricultural productsinside green house.Study of green house equipments. Visit to various Post Harvest Laboratories.Determination of Moisture content of various grains by oven drying & infrared moisturemethods. Determination of engineering properties (shape and size, bulk density and porosity ofbiomaterials).Determination of Moisture content of various grains by moisture meter.Field visitto seed processing plant.

References:

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic 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. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

Course Outcome:

At the end of the course, a student will be able to –

CO1 Develop concept of greenhouse technology, types of green houses and construction of green houses.

CO2 Create knowledge of Green house equipment's and its Irrigation System.

CO3 Discuss Engineering properties and hydro dynamic properties of pulses, oilseeds and cereals.

CO4 Assess drying and dehydration method.

CO5 Discuss the material handling equipments their working and principles.

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course Outcome	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L6	M	-	L	H	L	M	-	L	H	M	L	H	H	M
CO2	L6	H	L	M	L	-	M	L	-	L	H	L	M	M	H
CO3	L2	L	M	-	H	L	L	-	H	M	L	M	L	M	-
CO4	L5	H	M	L	-	L	M	H	M	-	M	L	H	H	M
CO5	L2	L	M	H	-	L	H	-	M	L	M	H	M	-	H

H- High, M- Moderate, L- Low "-" for no correlation

Course Delivery Methods (CD)

CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO2,CO5

AG 603	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)

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, ratoo stunting and PokkahBoeng; Sunflower: n

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

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

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; Chillies: 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 visit for the diagnosis of field problems.Collection and prese*rv*ation of plant diseased specimens for herbarium.

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

References

1. Cook, AA. 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.

8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

9. Singh, R.S.1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Course Outcome

At the end of this course students will be able to

CO1: Idetify pathogens of different Rabi diseases in feild.

CO2: Acquire the knowledge about etiology, and symptoms of diseases in Rabi Plants

CO3: Trace the diseases Cycle of different Pathogens in Rabi Season.

CO4: By knowing means of dispersal Rabi diseases suitable management methods can be applied.

CO5: Examine the pathogen under microscope.

CO6: Acquire Knowledge of Collecting in field and preserving different diseases sample in lab

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L1	H	H	-	-	-	-	H		M	H	-	-	H	M
CO2	L1	H	H	M	-		-	H	-	-	H	-	-	H	H
CO3	L4	H	H	M	-	-	-	H	-	L	H	M	M	M	H
CO4	L1,L2	H	H	H	-	H	H	-	L	H	H	M	L	H	-
CO5	L4	H	H	H	M	H	M		-	-	H	L	-	-	H
CO6	L1,L2	M	H	H	-	M	H	-	-	-	H	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD1	Lectures by use of board/LCD/	CO1,CO2,CO3,CO4
CD2	Tutorial/Assignments	CO1, CO2,CO3,CO4
CD3	Seminar	CO2,CO3,CO4
CD4	Self learning	CO1,CO2,CO4
CD5	Field Visit	CO5,CO6

AG 604	Post-Harvest Management and Value Addition of Fruits and Vegetables	2(1+1)

Course objective-

- To understanding environment, growth parameter, causes of post harvest losses, management and value addition**.**
- To providing 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 causesof post harvest losses;

UNIT-B Pre-harvest factors affecting postharvest quality, maturity, ripening andchanges occurring during ripening;

UNIT-C Respiration and factors affecting respiration rate; Harvestingand 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 Tomatoproducts- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept andmethods, osmotic drying. Canning -– Concepts and Standards, packaging of products.

Practical

Applications of different types of packaging, 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:

1. Battacharjee, S. K. and De, L. C.,(2005). Post Harvest Technology of Flowers and Ornamentals Plants, Pointer Publisher
2. Jacob John, P., (2008). A Handbook on Post Harvest management of Fruits and vegetables, Daya Publishing House, Delhi
3. Manoranjan, K. and Sangita, S.,(1996) Food Preservation & Processing, Kalyani Publishers
4. Mitra, S. K. (1997) Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CAB International
5. Verma, L. R. and Joshi, V. K. (2000) Post Harvest Technology of Fruits and Vegetables Vol. I & II, Indus Publishing Co., New Delhi
6. Vijay, K.,(2001).Text Book of Food Sciences and Technology, ICAR

Course outcome-

At the end of course students will be able to

CO1: Know the post harvest technology of horticultural crops.

CO2: Know preservation and value addition of horticulture crops.

CO3: Explain the work space, tool and equipment design and its uses for PHT and value addition.

CO4: Describe the various certification and accreditation i.e. FPO, ISO and other leveling.

CO5: Explain the different types of packing

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/Cos	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	H	M	M	M	H	H	H	M	H	-	-	M	L
CO2	L1,L5	H	H	M	M	H	H	M	L	L	L	M	M	L	M
CO3	L2,L6	M	M	H	H	L	H	M	L	L	M	L	M	M	M
CO4	L1	H	M	H	M	M	L	H	L	L	L	L	L	H	-
CO5	L2	H	L	M	H	M	H	M	M	L	M	M	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	CO2,CO3, CO5

AG-605	Management of Beneficial Insects	2(1+1)

Course Objective-

- To know about importance, major species and biology of beneficial insects.
- To understand commercial methods of rearing and management of beneficial in insects
- To control the insect pest and diseases of apiculture, sericulture and lac culture and their management.
- To understand about mass production technique 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 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 pollinator, 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, voltinismand biology of silkworm.Mulberry cultivation, mulberry varieties and methods of harvestingand 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.

Reference:

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 Publising 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.

Course Outcomes:

At the end of this course students will be able to

CO 1: Adopt the apiculture, sericulture and lac culture as an entrepreneur according to agro climatic zone.

CO 2: Apply commercial methods of rearing, equipment, seasonal management, insect-pest and disease and important species for commercial use of honey bee, silkworm and lac insect.

CO 3: Identify and demonstrate different bio control agents (Predator, Parasite and Parasitoids) and their use for sustainable pest management.

CO 4: Learn and adapt the mass multiplication technique of biological control agents and established a bio control lab in future as an entrepreneur.

CO5: Justify recommendation of bio-control agents in sustainable crop insect-pest management.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L5	H	-	M	H	-	-	M	M	-	H	M	H	-	H
CO2	L3	H	H	M	H	M	H	H	H	-	H	-	H	M	M
CO3	L2, L3	H	-	L	-	H	L	H	-	H	H	-	-	H	-
CO4	L2, L3	H	H	H	H	-	H	H	M	M	H	-	H	M	H
CO5	L5	H	M	M	-	M	-	H	-	H	H	M	-	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO2

AG 606	Crop Improvement-II *(Rabi crops)*	2 (1+1)

Course objectives

- To provide training of breeding methods on field.
- To create abilitiy for evaluate resistant varieties with breeding practices in the field.
- To provide field training for observe and classify the field crop on 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, itsutilization and conservation;

UNIT-C Study of genetics of qualitative and quantitative characters;

UNIT-D Majorbreeding objectives and procedures including conventional and modern innovative approachesfor development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stresstolerance and quality (physical, chemical, nutritional);

UNIT-E Hybrid seed production technology of rabicrops. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent 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:

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, AK., 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 Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co..INC, East Port, Conneacticut, 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.

Course Outcomes:

At the end of this course students will be able to

CO1: Understand the importance of wild relative and utilized them to produce new varieties of Rabi crop.

CO2: Know the gene preservation method for further use to improve Rabi varieties.

CO3: Apply breeding methods to improve and develop the Rabi crops.

CO4: Identify and evaluate the resistance gene relate to Rabi crop with high yield potential against pest and pathogen and utilization of genetic information.

CO5: Understand the new genetic approaches to achieve a definite ideotype of Rabi crop.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2, L3, L4,	M	L	-	M	L	L	M	L	M	L	L	L	H	-
CO2	L1, L3, L6	M	M	L	L	L	M	L	L	M	H	L	L	M	L
CO3	L3, L6	H	L	M	M	M	L	L	L	L	L	M	M	M	M
CO4	L4, L5	H	-	L	L	M	L	-	L	L	M	L	L	H	L
CO5	L2	M	L	M	M	H	-	L	M	L	L	M	L	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3

CD5	Industrial visit	CO5

AG-607	Practical Crop Production – II (Rabi crops)	1(0+1)

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 (10^{th} edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2^{nd} edition), Agrobios (India), Jodhpur.
3. Reddy, S. R. 2016. Principles of Agronomy (5^{th} edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5^{th} Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Course Outcome

At the end of this course, students will be able to

CO.1: Acquaint with the knowledge of profitable crop production technology.

CO.2: Understand and design the ruminative crop production techniques.

CO.3. Adopt diversified farming system according to available farming situation.

CO.4. Encourage the sustainable agriculture system.

CO.5. Analyse the different profitable farming system.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	H	M	L	H	M	M	M	-	M	H	H
CO2	L2,L6	M	L	H	H	H	L	M	L	M	H	-	H	M	H
CO3	L3	H	-	H	M	M	M	H	M	M	M	-	H	H	M
CO4	L2,L3	H	L	L	M	H	-	L	M	L	M	-	M	L	M
CO5	L4	M	M	H	H	L	L	M	M	M	H	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Method(CD)		
CD1	Lectures by use of board /LCD	CO1, CO4
CD2	Tutorial/ Assignments for field operations	CO2, CO3,CO5
CD3	Seminar	CO1,CO3
CD4	Self learning cum doing	CO2, CO4
CD5	Field Visit	CO3, CO4,CO5

Mapping between COs and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4
CD5	Industrial visit / Field visit	CO5

AG 608	Principles of Organic Farming	2(1+1)

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 faming.

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, Agrtech, Publising Academy, Udaipur.

Course Outcomes

At the end of this course students will be able to

CO1 Explain the initiative of Government for organic products.

CO2 Describe the role of NGOs in producing organic products and use of organic produce in current agriculture scenario.

CO3 Identify the crops varieties for organic production and to control insect pest in organic farming.

CO4 Illustrate the organic produce certification procedure and know the operation structure of national programme on organic production.

CO5 Demonstrate the organic production on-farm.

CO6 Know about the post harvest management of organic products.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	M	M	L	L	M	M	-	-	-	M	-	L	H	H
CO2	L2, L3	M	M	L	-	M	L	-	-	L	M	-	L	M	H
CO3	L2, L4	H	H	H	M	H	M	M	H	H	H	M	M	M	L
CO4	L1,L3	M	M	L	-	M	-	M	L	M	M	-	M	H	H
CO5	L3	H	H	M	M	H	M	H	M	H	H	L	H	M	H
CO6	L1	M	M	M	-	M	H	M	M	L	M	M	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery methods

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and COs

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4
CD5	Industrial visit / Field visit	CO5, CO6

AG 609	Farm Management, Production & Resource Economics	2(1+1)

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 analyse 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 equip-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of input 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.

Course Outcome:

At the end of the course, a student will be able to understand –

CO1: The course contains a comprehensive treatment of the traditional agricultural production economics topics employing both detailed graphics and differential calculus.

CO2: Focus on the neoclassical factor-product, factor-factor and product- product models, and is suitable for an advanced undergraduate or a beginning graduate –level course in static production economics.

CO3: Understand limited resources available in the economy. Realize the need to exploit and utilize through development and improvement of production techniques.

CO4: Make them aware of the availability of rich natural endowments to achieve sustainable agricultural development with this knowledge they can challenge the problems of unemployment inequality shortage of food productions poverty and be useful to compete advanced agricultural economies.

CO5: Gain knowledge of the causes of regional variations in productivity and production, Social and economic inequality size of land holdings and lack of quality inputs ets and Suggest appropriate measures for the whole economy

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4,L6	H	M	L	-	L	-	-	H	H	M	-	H	M	M
CO2	L6,L5, L4	H	-	M	-	H	H	-	M	-	-	-	H	-	H
CO3	L6,	M	-	L	-	M	L	-	H	M	-	-	M	M	M
CO4	L3,	H	M	-	-	M	H	M	H	H	M	-	M	H	M
CO5	L6	H	M	-	-	L	H	-	H	H	-	-	H	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4 ,CO5
CD5	Industrial Visit / Field Visit	CO5

AG 610	Principles of Food Science & Nutrition	2(2+0)

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 bioactives, 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.

Course outcome-

At the end of course students will be able to

CO1 Explaining the ideas and information on food science and nutrition issues appearing in the popular press.

CO2 Discuss the important pathogen and spoilage microorganism in foods.

CO3 Describe basic principles and practices of cleaning and sanitation in food preparation operation.

CO4 Identity and explain nutrients in foods and the specific functions in maintaining health.

CO5 Design a Balanced and modified diets formulate menu planning make health better.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L2	L	H	H	H	H	M	L	M	L	M	M	M	L	H
CO2	L2	M	H	M	M	H	M	L	M	M	M	M	M	-	H
CO3	L2	H	H	M	H	H	M	L	M	M	M	M	M	M	M
CO4	L2	M	M	H	H	M	M	L	M	M	H	M	H	-	H
CO5	L6	H	M	M	M	M	M	M	M	M	H	M	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4,CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4 ,CO5
CD5	Industrial visit / Field visit	CO3, CO5

AG- 611A	Weed Management (Elective Course)	3 (2 + 1)

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 agro-chemicals 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.

References:

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 Outcome

At the end of course students will be able to

CO1: Types of weeds with examples, propagation and dissemination vis-a-vis classification for their effective control

CO2: Discus the characteristics, utility and damage caused by weeds

CO3: Herbicidal, bio-herbicidal,allele-chemicals properties and their use in agriculture

CO4: Understand weed resistance and its management

CO5: Calculate weed indices, weed control efficiency of different weed control measures and cost of weed management

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	**Blooms Level**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4, 2	H	H	M	-	H	M	-	M	M	H	-	-	M	H
CO2	L 2	H	-	M	M	H	M	-L	H	M	L	L	H	H	H
CO3	L3,	H	H	H	H	H	H	-	M	H	H	L	H	M	H
CO4	L 2, 3, 1	H	M	-	L	H	H	-	L	H	M	L	-	H	M
CO5	L 4	H	H	H	M	H	H	-	L	H	M	L	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4,CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4 ,CO5
CD5	Industrial visit / Field visit	

AG 611B	Micro Propagation Technologies (Elective Course)	3 (2 + 1)

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.

Course Outcome:

CO1 Know the concept of plant tissue culture

CO2 Demonstrate the micro propagation

CO3 Know the morphogenesis

CO4 Discuss concept of somatic embryogenesis

CO5 Use of in vitro techniques in crope improvement

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	L	H	M	L	-	L	-	L	-	-	M	L	M
CO2	L3	H	-	-	L	-	L	-	M	-	-	-	H	-	M
CO3	L1	M	-	-	L	-	-	L	-	-	-	-	-	L	-
CO4	L2	-	L	-	H	-	-	-	-	-	-	-	-	-	-
CO5	L3	H	-	H	H	H	-	L	M	M	L	L	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO5
CD3	Seminars	CO1, CO2, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit / Field visit	CO2, CO5

AG 611C	Hi-Tech Horticulture (Elective Course)	3 (2 + 1)

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.

Course Outcome:

At the end of this course students will be able to

CO1 Use plant vegetative structure.

CO2 Understand basic principles, processes and plant propagation methods.

CO3 Understands to propagate plant, manage and harvest a variety of plant.

CO4 Known about horticulture future relates to the economy and environments.

CO5 Apply the knowledge about quality requirement and protected cultivation: advantages, controlled conditions.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	L	M	H	H	M	M	M	-	M	M	M	L	-
CO2	L2	M	M	H	H	L	L	-	-	L	M	-	-	M	-
CO3	L2	H	L	H	M	M	L	L	L	-	L	L	-	M	-
CO4	L1	M	M	H	M	L	M	M	M	M	L	-	L	H	L
CO5	L1, L3	H	M	M	L	M	M	L	L	L	M	M	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2,CO3, CO5

AG 611D	System Simulation and Agro-Advisory (Elective Course)	3 (2 + 1)

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 forecast 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 agroadvisory.

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

Course Outcomes:

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

CO 1 Explain the role of Agro-Advisory in agriculture and its relation to other areas of agriculture.

CO 2. Know about Crop models, concepts, techniques, types, data requirements**.**

CO 3. Practice the concept of ITK for weather forecasting.

CO 4. Prepare the crop weather calendars according to weather forcasting.

CO 5. Understand the concept of agro meteorological Observatory.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2,L4	H	L	L	-	M	-	L	-	H	M	-	-	M	-
CO2	L1	M	M	H	L	L	M	L	L	M	L	-	L	M	L
CO3	L3	M	-	M	M	M	M	L	L	H	M	L	M	H	-
CO4	L6	H	L	M	L	-	M	L	M	M	H	L	M	-	M
CO5	L2	M	H	M	H	M	H	M	L	M	L	M	H	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4 , CO5

SEMESTER-VII

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

Objectives of RAWE Programme:

1. To understand the rural community life and different situations prevailing in villages with special reference to agriculture.
2. To help students to get acquaint with the socio-economic conditions of farmers and their problems with reference to agricultural development.
3. To provide an opportunity to students for practical training in Crop Production, Plant Sciences, Plant Protection, Social Sciences, Animal Production & Dairying, Agrobased Industries and Skill Oriented Training through work experience.
4. To develop communication skill among students in using extension teaching methods in transfer of technology in the villages.
5. To make students to understand the agricultural technologies being followed by farmers and to prepare alternate farm plans to suit to the local situations in consultation with the farmers.
6. To develop confidence and competence in students for solving problems related to agriculture at farmers field.
7. To provide an opportunity to work with KVKs and agro based industries.
8. To help students to acquaint with the on-going thrust agricultural programmes and related transfer of technology (TOT), programmes in agriculture.
9. To impact diagnostic and remedial practical training and skill in crop production, protection through work experience.
10. To develop the communication skills, confidence and competence among the students to interact with the farmers so as to prepare Project Reports on village development plan.

Components of RAWE:

General Orientation & on campus training by different faculties
Village attachment
Unit attachment in University/College. KVK/Research Station
Plant Clinic
Agro-Industrial Attachment
Project Report Preparation, Presentation and Evaluation

Course Outcome

At the end of RAWE programme, a student will be able to –

CO1 Correlate theory and its applications for confidence building
CO2 Develop the art of creative thinking
CO3 Identify the gap between theory and practical

CO4 Observeproblemandpossiblesolution
CO5 Understanding and practicing local (ITK)and scientific methods for effective decision
CO6 Develop skill for working in local institution/organization and agro based industries
CO7 Learning business network including outlets of the industry
CO8 Understand various processing units and hands-on trainings with ethics of industry
CO9 Able to communicate the agricultural information and Transfer of Technology to the farmers community.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO 1	L2	M	H	-	-	L	-	L	-	M	-	-	-	L	L
CO 2	L3, L4	L	H	H	H	-	M	L	L	L	-	-	-	-	L
CO 3	L4,L5	H	L	M	M	M	M	L	L	M	-	-	-	H	-
CO 4	L2, L4	M	H	H	H	H	H	L	M	M	-	L	L	L	L
CO 5	L2	M	M	M	M	H	H	M	M	M	M	M	-	M	-
CO 6	L3, L6	-	M	H	M	M	L	M	M	M	-	M	H	M	M
CO 7	L2, L3	-	M	M	H	L	H	M	M	-	-	M	H	-	H
CO 8	L2,L3	-	M	-	-	-	H	L	M	L	-	H	L	L	-
CO 9	L5,L6	-	L	M	H	M	M	-	H	-	-	-	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO3, CO9
CD2	Tutorials/Assignments	CO2, CO4, CO4
CD3	Seminars	CO7, CO8. CO9
CD4	Self- learning advice using internets	CO5, CO7, CO8
CD5	Industrial visit / Field visit	CO3,CO5,CO6,CO7,CO8, CO9

SEMESTER- VIII

Modules for Skill Development, Entrepreneurship and Agro-industrial Attachment

Objective:

1. To expose the students to industrial environment which cannot be simulated in the university.
2. To formalize the students with various materials, machines, processes, products and their applications along with relevant aspect of the shop management.
3. To make the students understand the psychology of the workers and approach to problems along with practices followed at factory.
4. To make the students understand the scope, functions and job responsibility-ties in various departments of an organization.
5. Expose to various aspects of entrepreneurship during the programme period.

AG 801	Production Technology for Bio-agents and Bio-fertilizers	10 (0+10)

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, Metarhyzium*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.

Course Outcomes:

At the end of this course students will be able to

CO1: Adapt bio-pesticides and bio-fertilizers in place of chemical fertilizers for sustainable development of agriculture.

CO2: Describe the mass production technique of bio-fertilizers and bio-pesticide in laboratory.

CO3: Conduct the survey for identification of bio-control agents present in field condition and in bio-pesticide laboratory.

CO4: Justify recommendation of bio-pesticide and bio-fertilizers to farmers for better pest control and maintain the soil health.

CO5: Observe the effect of bio-pesticide on pest population and bio-fertilizers on soil health.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	-	-	M	H	-	H	-	H	H	M	-	M	H
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	H	M
CO3	L1, L4	M	H	M	-	-	M	H	H	M	M	-	M	H	M
CO4	L5	H	H	-	H	M	-	H	-	M	H	M	H	-	H
CO5	L2	H	-	M	-	M	H	H	-	H	H	L	-	M	H

H - High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO3

AG-802	**Seed Production& Technology**	**(0+10,)**

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 plant.

Maintenance of genetic purity during seed production, seedquality; 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. DhirenraKhare and Mohan S. Bhale.2000. Seed Technology. Scientific Publishers
5. (India), Jodhpur.
6. Maloo,S.R., Intodia, S.K. and Pratap Singh.2008. Beej Pradyogiki.Agrotech Publishing Academy.
7. A.K. Joshi and B.D. Singh.2005.Seed Technology. Kalyani Publishers, New Delhi.
8. Saxena,R.P.1984. BeezSansadhan, GBPA&T, Pantnagar.
9. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

Course Outcomes:-

At the end of this course students will be able to

CO1 know seed production program for fill full the requirement of pure seed in market and increase the income.

CO2 Understand the seed Storage to solve the availability crises of varietial seed due to adverse environmental conditions.

CO3 Produce and distribute the disease free seed in the market to get the environment friendly cultivation of crops.

CO4 Understand seed quality to increase the farm income by producing high yielding disease free quality seed and decrease the cost of cultivation also.

CO5 Know about hybrid seed Production of different crops to increase the farm income.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	H	L	M	-	L	-	L	-	M	L	-	L	M	M
CO2	L2L4	M	M	L	-	L	M	-	L	L	L	L	-	M	-
CO3	L3L4	M	L	L	L	H	L	L	L	M	-	M	L	H	L
CO4	L2L4	M	M	M	-	L	M	L	L	L	M	L	-	M	-
CO5	L1	H	L	L	L	H	L	M	M	M	L	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO4, CO45

AG 803	Mushroom Cultivation Technology	10 (0+10)

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 paddystraw 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. MishraTechnique of Mushroom Cultivation
5. Rajan S. Mushroom Technology .CBS Publisher and Distributer

Course Outcome:

At the end of this course students will be able to

CO1: Differentiate between edible and non edible mushroom

CO2: Produce mushroom span.

CO3: Prepare casing for Muhroom prodution

CO4: Prepare Value Added Product of Mushroom

CO5: Establish Mushroom cultivation Project.

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

CO	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	L4	H	M	L	-	L	-	M	-	L	H	L	L	M	L
CO 2	L3	M	H	M	M	L	L	-	-	-	M	-	H		M
CO 3	L1,L6,	M	-	M	M	-	M	-	-	-	H	-	-	L	-
CO 4	L6	H	-	M	M	L	M	-	-	L	H	L	L	L	L
CO 5	L6	H	M	L	H	H	M	-	M	-	H	L	H	-	M

Course Delivery Method

CD1	Lectures by use of board/LCD/	CO1,CO3,CO4,CO5
CD2	Tutorial/Assgnments	CO2,CO3
CD3	Seminar	CO5
CD4	Self learning	CO1
CD5	Lab work	CO2,CO3,CO5

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO2
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO3

AG 804	Soil, Plant, Water and Seed Testing	10 (0+10)

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 SomaniL.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 AgriculturalResearch, New Delhi.
3. Hybrid Seed Production in Field Crops: Principles and Practices by N. C. Singhal, 2003,
   a. Kalyani publication, Delhi

Course Outcomes

At the end of this course students will be able to

CO1 Compare the different seed processing methods.

CO 2 Explain the role of WTO and OECD in seed marketing.

CO 3 Know about water holding capacity and water resourses.

CO4 Design different field plot fertilizer trials and greenhouse pot experiments.

CO5 Demostrate the seed production methods on farms.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4	H	M	M	M	L	M	H	M	M	H	-	M	H	M
CO2	L2	H	M	H	-	-	-	M	M	L	M	-	H	-	H
CO3	L1	H	M	M	M	-	H	M	M	H	M	-	-	H	L
CO4	L6	H	L	H	H	M	H	M	M	M	H	-	M	L	M
CO5	L3	H	-	H	H	M	M	M	H	H	M	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

AG 805	Commercial Beekeeping	10 (0+10)

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.

Course Outcomes:

At the end of this course students will be able to

CO 1: Adopt the apiculture as an entrepreneur according to agro climatic zone.

CO 2: Apply commercial methods of rearing, equipment, seasonal management, insect-pest and disease and important species for commercial use of honey bee.

CO 3: Identify and demonstrate different commercially important honey bee species.

CO 4: Learn about important insect pest and disease of honey bees.

CO5: Justify recommendation regarding beekeeping to the farmers and entrepreneurs for commercial beekeeping.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	-	M	H	-	-	M	M	-	H	-	H	-	M
CO2	L3	H	H	M	H	M	H	H	H	-	H	-	H	-	H
CO3	L1, L3	H	-	L	-	H	L	H	-	H	H	-	-	H	-
CO4	L2	H	H	H	H	-	H	H	M	M	H	-	H	M	H
CO5	L5	H	M	M	-	M	-	H	-	H	H	H	-	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO2

AG 806	Poultry Production Technology	(0+10)

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 feather and function and different type of comb and function (Demo). External body poultry. Respiratory, ciculatory diigestive and excretory system. Male and female reproductive system. Egg structure and its function.Nervours 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 ofpoultry. Planning and layout of housing forpoultry 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 (10^{th} Edition), Delhi

Course outcome:

At the end of this course students will be able to

CO1: Acquire the basic knowledge about the techniques for poultry production meat and table eggs.

CO2: Conduct post-mortem and use the knowledge of significant diseases in poultry production.

CO3: Evaluate the quality of poultry meat and eggs.

CO4: Conduct laboratory analyses applying central techniques related to the respective areas.

CO5: Formulate diet for poultry.

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L6,	M	M	-	H	H	H	H	-	-	M	M	H	-	H
CO2	L6,	H	M	H	H	H	L	M	H	M	L	M	H	M	M
CO3	L5	M	M	L	H	H	H	M	H	L	M	H	H	L	H
CO4	L3	M	H	H	H	M	M	M	M	H	H	H	H	H	M
CO5	L6	H	M	H	H	H	-	M	H	L	M	H	H	L	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4,CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO3,CO5

AG 807	Commercial Horticulture	10(0+10)

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.

Course outcome:

At the end of course students will be able to

CO1: Demonstrate a fundamental understanding of plant identification, propagation, orchard establishment, use and maintenance of plant material best suited for conventional and sustainable horticulture.

CO2: Apply horticultural skills and knowledge to operate various business entities found in the horticultural industry.

CO3: Demonstrate an understanding of the composition, fertility and biology of soil and how they relate to good plant growth.

CO4: Identify and practice safe use of tools, equipment and supplies used in horticulture careers.

CO5: Identify and research career opportunities in the horticulture industry as well as emerging trends.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1, L3	H	L	H	L	H	H	M	H	H	H	L	M	M	H
CO2	L1, L3	H	M	M	H	M	M	M	M	M	M	-	M	M	M
CO3	L2, L3	M	H	H	-	H	-	M	L	H	M	L	-	M	L
CO4	L2	H	M	-	-	H	H	-	-	H	H	-	H	M	-
CO5	L2, L4	H	L	M	M	-	-	M	-	-	-	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4 , CO5
CD5	Industrial visit / Field visit	CO5

AG 808	Floriculture and landscaping	10(0+10)

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.

Course outcome:

At the end of course students will be able to

CO1: Identify metrological instruments and understand the diversity within the profession of Floriculture following safety precautions.

CO2: Identify the Plant morphology, different plant varieties and plant families.

CO3: Identify and choose different propagation methods, Handling of seed, bulbs, cut flowers, Nursery plants, pot plants.

CO4: Plan and execute Survey for landscaping and various types of indoor gardening.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L1, L2	H	-	-	M	H	-	H	-	H	H	M	-	M	-
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	L	-
CO3	L2	M	H	M	-	-	M	H	H	M	M	-	M	L	-
CO4	L5, L6	H	H	-	H	M	-	H	-	M	H	-	H	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO2, CO4

AG 809	Food Processing	10(0+10)

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, NewDelhi- 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.

Course outcome:

At the end of course students will be able to

CO1: Define Freezing: requirements of refrigerated storage.

CO2: Discuss Normal drying curve, effect of food properties on dehydration.

CO3: Demonstrate Ionizing radiation and sources.

CO4: Formulate and practice Packaging: Properties of packaging material, factors determining the packaging requirements.

CO5: Discuss and apply in research career opportunities in the Food industry as well as emerging trends.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/Cos	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1	M	M	H	L	H	H	M	H	H	H	M	H	M	M
CO2	L2	H	M	M	H	M	L	M	M	H	M	M	H	H	H
CO3	L3	M	H	H	H	H	H	M	L	H	M	L	H	M	M
CO4	L6	H	M	M	M	H	H	H	H	H	H	H	H	H	H
CO5	L2, L3	H	M	M	M	H	M	H	M	M	M	H	H	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping of CO with CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4

AG 810	Agricultural Waste Management	10 (0+10)

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 methodsBiomass 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 ZenonFoltynowicz, 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, LiseAppels, Tianwei Tan and RafDewil, Bioethanol from Lignocellulosic Biomass: Current Findings Determine Research Priorities The Scientific World Journal, 2014, Article ID 298153, 13 pages.

Course Outcomes:

At the end of the course student will be able to:

CO1: Understand applications, fundamental aspects and technological methods of waste management.

CO2: Apply various eco-friendly methods for agricultural waste management.

CO3: Evaluate and apply nutritive value and energy production potential of agro wastes.

CO4: Analyze economic analysis of briquetting, setting up of briquetting and plant- appliances for biomass briquettes.

CO5: Understand factors affecting – nutrient value and utilization of biogas slurry.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L1,L2	H	-	M	H	-	H	M	-	M	M	-	H	M	M
CO2	L3	H	-	-	H	M	-	M	H	-	H	M	H	-	H
CO3	L3, L5	M	H	M	H	H	M	-	H	M	M	-	M	L	L
CO4	L4	H	H	M	H	M	-	H	-	M	H	-	H	M	M
CO5	L2	H	-	M	-	M	H	H	M	H	H	M	-	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2
CD3	Seminars	CO1, CO2,CO4,CO5
CD4	Self- learning advice using internets	CO3, CO5
CD5	Industrial visit / Field visit	CO2

AG 811	Organic Production Technology	10(0+10)

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 faming.

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, Agrtech, Publising Academy, Udaipur.
5. Singh SP. (Ed.). 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
6. Lampin N. 1990. Orgnaic Farming. Press Books, Ipswitch, UK.

Course Outcomes

At the end of this course students will be able to

CO1 Explain the initiative of Government for organic products.

CO2 Describe the role of NGOs in producing organic products and use of organic produce in current agriculture scenario.

CO3 Identify the crops varieties for organic production and to control insect pest in organic farming.

CO4 Illustrate the organic produce certification procedure and know the operation structure of national programme on organic production.

CO5 Demonstrate the organic production on-farm.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	M	M	L	L	M	M	-	-	-	M	-	L	-	-
CO2	L2, L3	M	M	L	-	M	L	-	-	L	M	-	L	L	L
CO3	L2, L4	H	H	H	M	H	M	M	H	H	H	M	M	H	M
CO4	L1,L3	M	M	L	-	M	-	M	L	M	M	-	M	M	M
CO5	L3	H	H	M	M	H	M	H	M	H	H	L	H	M	M
CO6	L1	M	M	M	-	M	H	M	M	L	M	M	H	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4
CD5	Industrial visit / Field visit	CO5, CO6

AG 812	Commercial Sericulture	10(0+10)

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, Tamilnadu, 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- imulberry 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.

Course outcome:

1. Define Origin and history of sericulture. Silk route and map of India and World; Temperate and tropical climate for sericulture practice.
2. DiscussEnvironmental impact of sericulture: Eco-friendly activity of sericulture; Employment generation in sericulture and role of women in sericulture.
3. Demonstrate Land and agro based part of industry. Industrial aspect of the industry; Silk reeling as a cottage industry; Handloom and power loom activities.
4. Demonstrate and practice Textile fibres: Natural and Synthetic fibres: Advantage of silk fibre over other fibres: International demand of silk. Function Central Silk Board; Role of State Department ofSericulture. Role of universities and NGOs in sericulture development.
5. Discussand apply in research career opportunities in the Sericulture industry as well as emerging trends.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1, L3	M	M	H	L	H	H	M	H	H	H	M	H	H	M
CO2	L4	H	M	M	H	M	L	M	M	H	M	M	H	M	H
CO3	L2, L3	M	H	H	H	H	H	M	L	H	M	L	H	-	M
CO4	L3, L4	H	M	M	M	H	H	H	H	H	H	H	H	H	H
CO5	L1	H	M	M	M	H	M	H	M	M	M	H	H	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4

AG 813	AGRIBUSINESS MANAGEMENT	10(0 +10)

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 agriculturalcommodities. Net present worthtechnique for selection of viableproject.Internal rate ofreturn.

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

Course outcome:

CO1 To know the fundamental marketing principles, role of marketing, marketing mix and observe the marketing problems dealt with by managers.
CO2 Recognize the various marketing channels and areas and means to develop business ventures
CO3 Assemble knowledge about organization and functioning of different institutions involved in agriculture marketing
CO4 Evaluate the project feasibility and encourage them to start new ventures.
CO5 Evaluate the Co-operatives in Agricultural Marketing

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L1,L2	M	M	H	L	H	-	L	H	-	H	M	M	-	L
CO2	L6,L2	H	M	M	-	M	L	M	M	H	M	L	M	-	M
CO3	L6	M	H	H	-	H	-	M	L	H	M	L	-	-	-
CO4	L5	H	M	-	-	H	H	-	-	H	H	-	H	L	M
CO5	L5	H	-	-	M	-	-	M	-	-	M	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4

AG 814	Agro-Advisory Services	10(0+10)

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 Agrometeological 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 Meteological Department, Ministry of Earth Sciences, Press released, New Delhi. 22: 240-243 (2015).

Course Outcome:

At the end of the course student will be able to:

CO1: Provides inputs to the farmers that can make a tremendous difference to the agriculture production.

CO2: Prepare the students to deal with the market information and promotion of agriculture.

CO3: Understand the impact of agro – advisory on crop production.

CO4: Develop contingency plan for weather codes in consultation with villagers, extension workers and scientist.

CO5: Assist the villagers for crops and water management planning with response to forthcoming season.

Mapping between Programme outcomes (POs) and Course Outcomes (COs):

CO	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	L3	H	-	L	M	L	H	H	H	H	H	H	M	H	M
CO 2	L4	-	L	M	L	M	H	H	M	-	L	M	L	-	L
CO 3	L5	M	L	M	L	L	H	L	H	H	H	M	L	H	L
CO 4	L6	M	H	H	H	M	H	L	H	-	M	L	-	-	-
CO 5	L6	L	L	M	M	M	H	L	M	H	M	M	H	H	H

H- High, M- Moderate, L- Low "-" for no correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO2, CO5

AG-815	Nursery Management	10(0+10)

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.

Course outcome

At the end of the course student will be able to

CO1 Understand the practical knowledge and propagation methods of horticulture crops.

CO2 Know the raising and maintenance of root stock.

CO3 Apply the knowledge about plant growth regulators and their uses in propagation.

CO4 Improve their skill for solving field problems and layout preparation.

CO5 Use of propagation media and understand the Tetrazolium salt test for determining germination.

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	H	H	M	M	M	-	M	H	M	H	L
CO2	L1	M	M	H	H	L	L	-	-	L	M	-	-	M	L
CO3	L1,L3	H	L	H	M	M	L	L	L	-	L	L	M	M	-
CO4	L4,L6	M	M	H	M	L	M	M	M	M	L	-	L	L	-
CO5	L2,L3, L5	H	M	M	L	M	M	L	L	L	M	M	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2,CO3, CO5

9. TEACHING-LEARNING PROCESS/ METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of physical sciences in a canonical manner. In this context, applications of physical science and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Physical sciences in practical sessions. These sessions provide vital insights into scientific concepts and draw learner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate programme provides great flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.
11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programmes:** Training programmes organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.

10. 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 Bilingual.
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.

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 semestersto 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.

SGPA (Si) = Σ (Ci x Gi) / ΣCi

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} 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.

CGPA = Σ (Ci x Si) / Σ 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 SGPA: 6.8	Credit: 24 SGPA: 7.8	Credit: 24 SGPA: 5.6	Credit: 23 SGPA: 6.0	Credit: 24 SGPA: 6.3	Credit: 24 SGPA: 8.0	Credit: 20 SGPA: 8.0	Credit: 20 SGPA: 8.0

Thus, CGPA= $\frac{20x6.8+24x7.8+24x5.6+23x6.0+24x6.3+24x8.0+20x8.0+20x8.0}{179}$ = 7.03

11. 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).

12. KEY WORDS:

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

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