

COURSE CURRICULUM
Of
BACHELOR OF SCIENCE (HONS)
AGRICULTURE
INSTITUTE OF AGRICULTURAL SCIENCES,
RANI DURGAVATI UNIVERSITY
(BASED ON FIFTH DEANS' COMMITTEE (ICAR) REPORT)



RANI DURGAVATI UNIVERSITY



INSTITUTE OF AGRICULTURAL SCIENCES

Rani Durgavati University, Jabalpur

PREFACE

The undergraduate course curriculum has been revised as per recommendation of Fifth Deans' Committee under the auspices of Indian Council of Agricultural Research, New Delhi. The restructured course curriculum also includes some additional and important topics of present day agriculture. The present document contains syllabus with semester wise distribution of subjects, lectures schedules and suggested relevant reference books. I thank the Head of Department and other faculty members of Agriculture, Rani Durgavati University for their cooperation and assistance in preparing the present document.

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BACHELOR OF SCIENCE (HONS) AGRICULTURE
Ist YEAR

Ist Semester								
COURSE DETAILS								
Course Code	Course Type	Course Title	Mid Term Exam	Practical	Assignment	External Theory	Total Marks	Credit Score
THEORY GROUP								
HOR-101	Core Course	Fundamentals of Horticulture	30	15	5	50	100	2(1+1)
BCB-102	Core Course	Fundamentals of Plant Biochemistry and Biotechnology	30	15	5	50	100	3(2+1)
SSA-103	Core Course	Fundamentals of Soil Science	30	15	5	50	100	3(2+1)
IFR-104	Core Course	Introduction to Forestry	30	15	5	50	100	2(1+1)
CCS-105	Core Course	Comprehension & Communication Skill in English	30	15	5	50	100	2(1+1)
AGR-106	Core Course	Fundamentals of Agronomy	30	15	5	50	100	4(3+1)
EMA-107	Remedial Course	Elementary Mathematics*/	40	-	10	50	100	2(2+0)*
IBO-108		Introductory Biology*	30	15	5	50	100	2(1+1)*
AGH-109	Remedial Course	Agricultural Heritage	40	-	10	50	100	1(1+0)*
EXT -110	Core Course	Rural Sociology & Educational Psychology	40	-	10	50	100	2(2+0)**

HYV-101	Non- gradial	Human Value and Ethics**	40	-	10	50	100	1(1+0)**
		NSS		100			100	2(0+2)**
		NCC		100			100	2(0+2)**
		Physical Education & Yoga Practices **		100			100	2(0+2)**
						TOTAL CREDITS	18+03*/04*+ 03*	

Major- Term End Theory Exam, Minor- Pre University Test Weightage – Attendance 50%, Three Class Tests/Assignments 50%

**Non Credit courses

Remedial courses: Introductory Biology/Elementary Mathematics*2 (1+1)/ 2(2+0)* (It is Mandatory to choose any one subject from Remedial Course)

IIst Semester

Course Details

Course Code	Course Type	Course Title	Mid Term Exam	Practical	Assignment	External Theory	Total Marks	Credit
Theory Group								
PBG-201	Core Course	Fundamentals of Genetics	30	15	05	50	100	3(2+1)
AGM-202	Core Course	Agricultural Microbiology	30	15	05	50	100	2(1+1)
SWC-203	Core Course	Soil and Water Conservation Engineering	30	15	05	50	100	2(1+1)
FCP-204	Core Course	Fundamentals of Crop Physiology	30	15	05	50	100	2(1+1)

FAE-205	Core Course	Fundamentals of Agricultural Economics	40	-	10	50	100	2(2+0)
FPP-206	Core Course	Fundamentals of Plant Pathology	30	15	05	50	100	4(3+1)
ENT-207	Core Course	Fundamentals of Entomology	30	15	05	50	100	4(3+1)
CSP-208	Core Course	Communication Skill and Personality Development	30	15	05	50	100	2(1+1)
EXT-209	Core Course	Fundamentals of Agricultural Extension Education	30	15	05	50	100	3(2+1)
				TOTAL			24(16+8)	

Major- Term End Theory Exam, Minor- Pre University Test Weightage – Attendance 50%, Three Class Tests/Assignments 50%

**Non Credit courses

Remedial courses : Introductory Biology/Elementary Mathematics*2 (1+1)/ 2(2+0)* (It is Mandatory to choose any one subject from Remedial Course)

**BACHELOR OF SCIENCE (HONS) AGRICULTURE
IIst YEAR**

III rd Semester								
Course Code	Course Type	Course Title	Mid Term Exam	Practical	Assignment	External Theory	Total Marks	Credit
Theory Group								
CPT-301	Core Course	Crop Production Technology–I (<i>Kharif Crop</i>)	30	15	05	50	100	2(1+1)
FPB-302	Core Course	Fundamentals of Plant Breeding	30	15	05	50	100	3(2+1)
AFC-303	Core Course	Agricultural Finance and Cooperation	30	15	05	50	100	3(2+1)
AIF-304	Core Course	Agricultural Informatics	30	15	05	50	100	2(1+1)
FMP-305	Core Course	Farm Machinery and Power	30	15	05	50	100	2(1+1)
PVS-306	Core Course	Production Technology of Vegetables and Spices	30	15	05	50	100	2(1+1)
ESD-307	Core	Environmental Studies and Disaster	30	15	05	50	100	3(2+1)

	Course	Management						
STM-308	Core Course	Statistics Method	30	15	05	50	100	2(1+1)
LPM-309	Core Course	Livestock and Poultry Management	30	15	05	50	100	4(3+1)
						TOTAL		23(14+9)

IVth Semester

Course Details

Course Code	Course Type	Course Title	Mid Term Exam			External Theory	Total Marks	Credit
				Practical	Assignment			
Theory Group								
CPT-401	Core Course	Crop Production Technology-II (Rabi crops)	30	15	05	50	100	2(1+1)
POL-402	Core Course	Production Technology for Ornamental Crops, MAP and Land Scraping	30	15	05	50	100	2(1+1)
REG-403	Core Course	Renewable Energy and Green Technology	30	15	05	50	100	2(1+1)

PSM-404	Core Course	Problematic Soils and their Management	40	-	10	50	100	2(2+0)
PFP-405	Core Course	Production Technology for Fruit and Plantation Crops	30	15	05	50	100	2(1+1)
PST-406	Core Course	Principles of Seed Technology	30	15	05	50	100	3(1+2)
FSA-407	Core Course	Farming System and Sustainable Agriculture	40	-	10	50	100	1(1+0)
AMT-408	Core Course	Agricultural Marketing Trade & Prices	30	15	05	50	100	3(2+1)
AMC-409	Core Course	Introductory Agro Meteorology & Climate Change	30	15	05	50	100	2(1+1)
CMB-410	Elective Course	Commercial Plant Breeding	30	15	05	50	100	3(1+2)
						TOTAL		22(12+10)

BACHELOR OF SCIENCE (HONS) AGRICULTURE
IIIrd YEAR

Vth Semester								
Course Details								
Course Code	Course Type	Course Title	Mid Term Exam	Practical	Assignment	External Theory	Total Marks	Credit
Theory Group								
IPDM-501	CoreCourse	Principles of Integrated Pest and Disease Management	30	15	05	50	100	3(2+1)
MFSM-502	CoreCourse	Manures, Fertilizers and Soil Fertility Management	30	15	05	50	100	3(2+1)
CSG-503	CoreCourse	Pests of Crops and Stored Grain and their Management	30	15	05	50	100	3(2+1)
DFHM-504	CoreCourse	Diseases of Field and Horticultural Crops and their Management –I	30	15	05	50	100	2(1+1)
CIK-505	CoreCourse	Crop Improvement-I (<i>Kharif Crops</i>)	30	15	05	50	100	2(1+1)
EDB-506	CoreCourse	Entrepreneurship Development and Business Communication	30	15	05	50	100	2(1+1)
GNP-507	CoreCourse	Geoinformatics and Nano- technology and Precision Farming	30	15	05	50	100	2(1+1)
PCP-508	Core Course	Practical Crop Production- I (<i>Kharif Crops</i>)	-	90	10	-	100	2(0+2)
IPR-509	Core Course	Intellectual Property Rights	30	15	05	50	100	1(1+0)
BBF-510	Elective Course	Biopesticides & Biofertilizers	30	15	05	50	100	3(2+1)
							TOTAL	24(14+10)

VI th Semester								
Course Details								
Course Code	CourseType	Course Title	Mid Term Exam					Credit
				Practical	Assignment	External Theory	Total Marks	
Theory Group								
RWM-601	CoreCourse	Rain fed Agriculture & Watershed Management	30	15	05	50	100	2(1+1)
PCA-602	CoreCourse	Protected Cultivation and Secondary Agriculture	30	15	05	50	100	2(1+1)
DHM-603	CoreCourse	Diseases of Field and Horticultural Crops and their Management-II	30	15	05	50	100	3(2+1)
PHT-604	CoreCourse	Post-harvest Management and Value Addition of Fruits and Vegetables	30	15	05	50	100	2(1+1)
MBI-605	CoreCourse	Management of Beneficial Insects	30	15	05	50	100	2(1+1)
CIR-606	CoreCourse	Crop Improvement-II (Rabi crops)	30	15	05	50	100	2(1+1)
PCP-607	CoreCourse	Practical Crop Production- II (Rabi Crops)	-	90	10	-	100	2(0+2)
POF-608	CoreCourse	Principles of Organic Farming	30	15	05	50	100	2(1+1)

FRE-609	CoreCourse	Farm Management, Production & Resource Economics	30	15	05	50	100	2(1+1)
FSN-610	CoreCourse	Principles of Food Science and Nutrition	40	-	10	50	100	2(2+0)
WEM-611	ElectiveCourse	Weed Management	30	15	05	50	100	3(2+1)
						TOTAL		24(13+11)

**Non Credit courses

Remedial courses: Introductory Biology/Elementary Mathematics*2 (1+1)/ 2(2+0)* (It is Mandatory to choose any one subject from Remedial Course)

Educational Tour will be organized after 6th semester.

**BACHELOR OF SCIENCE (HONS) AGRICULTURE
SEMESTER VII**

S.NO.	RURAL AGRICULTURAL WORK EXPERIENCE AND AGRO-INDUSTRIAL ATTACHMENT (RAW AND AIA)		
	ACTIVITIES	CREDITS HOURS	MAXIMUM MARKS
COMPONENT I RURAL AGRICULTURAL WORK EXPERIENCE (RAW)			
1	Survey of village	0+1	50
2.	Agronomical Interventions	0+3	50
3.	Plant protection Interventions	0+2	50
4.	Soil Improvement Interventions (Soil sampling and Testing)	0+2	50
5.	Fruit and vegetable Production Interventions	0+3	50
6.	Food processing and storage Interventions	0+1	50
7.	Animal Production Interventions	0+1	50
8.	Extention and Transfer Technology activities	0+3	50
COMPONENT- II: AGRO-INDUSTRIAL ATTACHMENT (AIA)			
9.	AGRO-INDUSTRIAL ATTACHMENT	0+4	50
	Total	20	450

**BACHELOR OF SCIENCE (HONS) AGRICULTURE
SEMESTER VIII**

VIIIth Semester		
S.No.	Course of Experiential Learning	Credit
1.	Organic Production Technology	(0+10)
2.	Production Technology for Bio-Agents and Bio-Fertilizers	(0+10)

Major- Term End Theory Exam

Mission: The key objective is to impart Education, Research and Extension for Sustainable Agricultural Development.

Vision:

- To develop excellent human resources and innovative technological services to farming community
- To create a platform for agriculture and allied fields knowledge and research activities
- To develop culture of continuous improvement, skill development and teamwork

Programme Objective:

- To gain knowledge of different streams of agriculture like agronomy, entomology, plant breeding, plant pathology, soil science etc. in practice.
- To study the competent professionally with ethical responsibility as an individual as well as in multidisciplinary teams with positive attitude.
- To devise communication and extension methodologies for transfer of Agricultural Technologies.
- To identify, critically analyzes, formulate and solve agriculture economics and marketing problems to benefit farmers.
- To able to design a system and process to meet desired needs of food and nutrition with the knowledge of protected cultivation and Post-Harvest Technology.

PROGRAMME OUTCOMES

- Agriculture programme is designed to prepare graduates to attain the following outcomes:
- An ability to apply knowledge of different streams of agriculture in practice. An ability to critically analyzes and solve marketing problems.
- An ability to design a system to meet desired needs of food and nutrition.

- An ability to devise and conduct experiments, interpret data and provide well informed conclusions.
- An ability to understand the practical problems faced by farmers and to find a proper solution for it.

EXAMINATION SYSTEM

Examination Scheme							
Subject	Marks Allotment					Examination Duration	
	External Theory	Mid-Term	Practical	Assignment	Total	Theory	Practical
Theory + Practical	50	30	15	05	100	3 Hr	2 Hr
Theory	50	40	---	10	100	3 Hr	-
Practical	---	---	100	---	100	-	3 Hr

ELIGIBILITY FOR AWARD OF THE B.SC. (HONS.) DEGREE:

As per Fifth Dean Committee recommendations a student shall be declared to be eligible for award of the degree if he/she has:

- a) Registered and successfully completed all subjects of Core, Optional and specialized Course, Lab classes/ practices, including Seminars, Workshop, Presentations, Group Discussion, Field Work/ Training, Educational Tour, Science Project Work/ Dissertation/ Thesis and other assignments etc. whichever applicable.
- b) Successfully acquired the minimum required credits as specified in the programme structure regulation of the course within the stipulated time,
- c) Earned the specified credits in all the subjects as applicable;
- d) Secured a CGPA of 5.0 or minimum 50% in aggregate or equivalent grade.

However the award of the CGPA/%MARKS/DIVISION/CLASS shall be as per the guidelines of Fifth Dean Committee of ICAR and concerned Board, of studies of the University as given in table below:

CREDIT BASED GRADING SYSTEM

S.N	% OF MARKS OBTAINED	CONVERSION IN TO POINTS
1	100	10 points
2	90 to 100	9 – 10

3	80 to 90	8 – 9
4	70 to 80	7 – 8
5	60 to 70	6 – 7
6	50 to 60	5 – 6
7	Below 50	Fail
8	Eg: 80.76	8.076
	43.60	4.360
	72.50 (but shortage in attendance)	Fail (1 point)

S.N	OGPA	DIVISION
1.	5.000 – 5.999	Fair/Pass
2.	6.000 – 6.999	II Division
3.	7.000 – 7.999	I Division
4.	8.000 and above	I division with Distinction

The Semester Grade Points Average (SGPA) and Cumulative Grade Point Average (CGPA) shall be calculated as under:

$$SGPA = \frac{\sum_{i=1}^n c_i p_i}{\sum_{i=1}^n c_i}$$

Where C_i is the number of credits offered in the i^{th} subject of a Semester for which SGPA is to be calculated, P_i is the corresponding grade point earned in the i^{th} subject, where $I = 1, 2, \dots, m$. n are the number of subject in the semester

$$CGPA = \frac{\sum_{j=1}^n SG_j NC_j}{\sum_{j=1}^n NC_j}$$

Here NC_j is the number of total credits offered in the j^{th} semester, SG_j is the SGPA earned in the j^{th} semester, where $j = 1, 2, \dots, m$, are the numbers of semesters in the course.

The conversion from grade to an equivalent percentage in a given academic programme shall be according to the following formula applicable.

$$\text{Percentage marks scored} = \frac{\text{CGPA obtained} \times 100}{10}$$

- e) No dues to the University Department, Hostels, Libraries, Sports, NCC/NSS etc.; and
- f) No disciplinary action is pending against him/her.

Attendance Requirement:

A candidate must have at least 75% attendance. Provided that, in case of illness or because of other genuine reason it shall be relaxed by the Vice-Chancellor to the extent (10%) deemed if as admissible within applicable regulations.

Maximum Duration for Completion of Programme:

Maximum permissible time for successful completion of this programme is 6 years. However in exceptional genuine cases one additional year may be granted as per the discretion of the Vice Chancellor.

General Instructions:

- (i) The admission to the B.Sc. (Hons.) Agriculture, B.Sc. (Hons.) Horticulture, B.Sc. (Hons.) Forestry and B.Sc. (Hons.) Food Science and Technology programme shall be governed in accordance with provisions of the Rules/Directives of UGC/ICAR or any other competent Authority of the Government of India/ State Government as amended from time to time.
- (ii) The relaxation in eligibility conditions, age and reservation etc. shall be in accordance with the Rules/Directives of UGC/relevant Regulatory Body mainly ICAR or any other competent Authority of the Government of India/ State Government as amended from time to time.

DISCIPLINE-WISE SUMMARY OF CREDIT HOURS

S.N.	Group	Credits
1.	Agronomy	21(10+11)
2.	Genetics & Plant Breeding	13(7+6)
3.	Soil Science & Agricultural Chemistry	8(6+2)

4.	Entomology	9(6+3)
5.	Agricultural Economics	10(7+3)
6.	Agricultural Engineering	8(4+4)
7.	Plant Pathology	13(9+4)
8.	Horticulture	10(5+5)
9.	Food Science	2(2+0)
10.	Agricultural Extension	9(6+3)
11.	Biochemistry / Physiology / Microbiology/ Environmental Sciences	12(7+5)
12.	Statistics, Computer Application and I.P.R.	5(3+2)
13.	Animal Production	4(3+1)
14.	English	2 (1+1)
15.	Remedial Courses	02 (Biol/ Math); 01 (Agriculture)
16.	NCC / NSS / Physical Education & Yoga	2(0+2)
17.	Human Values and Ethics	1(1+0)
18.	Educational Tour	2(0+2)
Total		126 + 2 (for Bio / Math)/ 01 (Agri) + 5 NC 126+2+1+5+ 9 credits Elective
RAWE, ELP		20 +20
Grand Total		143+20+20=183

NEW COURSES

S.No.	Course Title	Credit Hours
1.	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)
2.	Rainfed Agriculture and Watershed Management	2(1+1)
3.	Problematic Soils and their Management	2(2+0)
4.	Renewable Energy and Green Technology	2(1+1)
5.	Management of Beneficial Insects	2(1+1)
6.	Fundamentals of Horticulture	2(1+1)
7.	Introduction to Forestry	2(1+1)
8.	Agricultural Informatics	2(1+1)
9.	Intellectual Property Rights	1(1+0)
10.	Principles of Food Science & Technology	2(2+0)
11.	Communication Skills and Personality Development	2(1+1)
12.	Principles of Integrated Pest & Diseases Management	3(2+1)
13.	Agricultural Heritage	1(1+0)*
14.	Introductory Biology	2(1+1)*
15.	Elementary Mathematics	2(2+0)*
16.	Human Values & Ethics (NG)	1(1+0)**

* Remedial courses** Non-gradual courses

DEPARTMENT WISE DISTRIBUTION OF COURSES

Discipline/Course title	Subject Code	Credit Hours
AGRONOMY		
Fundamentals of Agronomy		4(3+1)
Crop Production Technology – I (<i>Kharif crops</i>)		2(1+1)

Crop Production Technology – II (<i>Rabi crops</i>)		2(1+1)
Farming System & Sustainable Agriculture		1(1+0)
Introductory Agro-meteorology & Climate Change		2(1+1)
Geoinformatics and Nanotechnology and Precision Farming		2(1+1)
Practical Crop Production - I (<i>Kharif crops</i>)		2(0+2)
Rainfed Agriculture & Watershed Management		2(1+1)
Practical Crop Production - II (<i>Rabi crops</i>)		2(0+2)
Principles of Organic Farming		2(1+1)
GENETICS & PLANT BREEDING		
Fundamentals of Genetics		3(2+1)
Fundamentals of Plant Breeding		3(2+1)
Principles of Seed Technology		3(1+2)
Crop Improvement-I (<i>Kharif crops</i>)		2(1+1)
Crop Improvement-II (<i>Rabi crops</i>)		2(1+1)
Protected Cultivation and Secondary Agriculture		2(1+1)
PLANT PATHOLOGY		
Fundamentals of Plant Pathology		4(3+1)
Principles of Integrated Pest and Disease Management		3(2+1)
Diseases of Field and Horticultural Crops and their Management-I		3(2+1)
Diseases of Field and Horticultural Crops and their Management-II		3(2+1)

HORTICULTURE		
Fundamentals of Horticulture		2(1+1)
Production Technology for Vegetables and Spices		2(1+1)
Production Technology for Ornamental Crops, MAP and Landscaping		2(1+1)
Production Technology for Fruit and Plantation Crops		2(1+1)
Post-harvest Management and Value Addition of Fruits and Vegetables		2(1+1)
FOOD SCIENCE & TECHNOLOGY		
Principles of Food Science & Nutrition		2(2+0)
Agricultural Extension and Communication		
Rural Sociology & Educational Psychology		2(2+0)
Communication Skills and Personality Development		2(1+1)
Fundamentals of Agricultural Extension Education		3(2+1)
Entrepreneurship Development and Business Communication		2(1+1)
Biochemistry / Physiology / Microbiology/ Environmental Sciences		
Fundamentals of Plant Biochemistry and Biotechnology		3(2+1)
Fundamentals of Crop Physiology		2(1+1)
Agricultural Microbiology		2(1+1)
Environmental Studies & Disaster Management		3(2+1)
Introduction to Forestry		2(1+1)

Statistics, Computer Application and I.P.R.		
Statistical Methods		2(1+1)
Agri- Informatics		2(1+1)
Intellectual Property Rights		1(1+0)
Animal Production		
Livestock and Poultry Management		4(3+1)
Language		
Comprehension & Communication Skills in English		2(1+1)
SOIL SCIENCE & AGRICULTURAL CHEMISTRY		
Fundamentals of Soil Science		3(2+1)
Problematic soils and their Management		2(2+0)
Manures, Fertilizers and Soil Fertility Management		3(2+1)
ENTOMOLOGY		
Fundamentals of Entomology		4(3+1)
Pests of Crops and Stored Grain and their Management		3(2+1)
Management of Beneficial Insects		2(1+1)
AGRICULTURAL ECONOMICS		
Fundamentals of Agricultural Economics		2(2+0)
Agricultural Finance and Co-Operation		3(2+1)
Agricultural Marketing Trade & Prices		3(2+1)

Farm Management, Production & Resource Economics		2(1+1)
AGRICULTURAL ENGINEERING		
Soil and Water Conservation Engineering		2(1+1)
Farm Machinery and Power		2(1+1)
Renewable Energy and Green Technology		2(1+1)
REMEDIAL COURSES		
Elementary Mathematics		2(2+0)
Introductory Biology		2(1+1)
Agricultural Heritage		1(1+0)
Non-Gradual Courses		
Human Values & Ethics		1(1+0)
NSS/NCC/Physical Education & Yoga Practices		2(0+2)
Educational Tour		2(0+2)

SEMESTER I / FIRST YEAR

S. N.	Subject Code	Subject Name	Credit
1	HOR-101	Fundamentals of Horticulture	2(1+1)
	BCB-102	Fundamentals of plant Biochemistry and	

2		Biotechnology	3(2+1)
3	SSA-103	Fundamentals of Soil Science	3(2+1)
4	IFR-104	Introduction to Forestry	2 (1+1)
5	CCS-105	Comprehension & Communication Skill in English	2(1+1)
6	AGR-106	Fundamental of Agronomy	4(3+1)
7	EMA-107/ IBO-108	Introductory Biology* / Elementary Mathematics*	2(1+1) /2(2+0)
8	AGH-109	Agriculture Heritage	1(1+0)
9	EXT -110	Rural Sociology & Educational Psychology	2(2+0)
10	HYV-101	Human Value and Ethics**	1(1+0)
11		NCC/NSS/Physical Education & Yoga Practices**	2(0+2)
Total Credit			18 (12+6) +
*R: Remedial course; **NC: Non-gradial courses			03*+03**

FUNDAMENTALS OF HORTICULTURE CREDITS 2(1+1)

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVES

- To give Basic knowledge about horticulture and division of Horticulture.
- To give all classification of Horticultural crops.
- To give the knowledge Horticultural practices there.
- To give the information garden tool and uses.
- To give the knowledge and identification of Horticulture crops.

THEORY

UNIT-I: Horticulture- Its definition and branches, importance and scope; horticulture. botanical classification of horticulture crops.

UNIT-II: Climate and soil for horticultural crops; Plant propagation-methods and propagating structure. principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation.

UNIT- III: unfruitfulness; pollination, pollinizer and pollinators; fertilization and parthenocarpy.

UNIT-IV: kitchen gardening; garden types and parts; lawn making; medicinal and aromatic plants; species and condiments.

UNIT-V: Use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity.

Practical:-

1. Identification of garden tools.
2. Identification of horticultural crops.
3. Preparation of seed bed/nursery bed.
4. Practice of sexual and asexual methods of propagation.
5. Layout and planting of orchard plants.
6. Training and pruning of fruit trees.
7. Transplanting and care of vegetable seedlings.
8. Making of herbaceous and shrubby borders.
9. Preparation of potting mixture, potting and repotting.
10. Fertilizer application in different crops.
11. Visits to commercial nurseries/orchard.

COURSE OUTCOME:

- Be able to develop commercially nursery and orchard.
- Be able to develop new plant through training, pruning, tree form function

- To develop aromatic and medicinal plants for medicinal and recreation purposes.

Suggested Readings

Text Books

1. Crues, W.V. 1958. Commercial Fruit and Vegetable products. IV (ed) The Mc. Graw – Hill Book Company, London.
2. Mitra, S. K. 1997. Postharvest Physiology and Storage of Tropical Fruits CABInternationalUK.
3. Panastico, B.M 1975. Postharvest physiology, handling and utilization of Tropical and sub- tropical Fruits and Vegetables. The AVI Publishing Company,INC
4. Purseglove, J.W. et al 1981. Spices, Longman, New York (2vols).
5. Ranganna, S. 1977. Manual of analysis of fruits and vegetables products. Tata Mc. Graw Hill Publishing Company,NewDelhi.

Reference Books

1. Dr. Jitendra Singh, Fundamental of Horticulture
2. S. N. Gupta InstantHorticulture
3. Bijendra Singh & Ashok ChouhanHorticulture
4. Dr. Shyam Sundar ShrivastavHorticulture
5. Dr. Jitendra Singh, BasicHorticulture
6. Prasad & Kumar Principles of Horticulture

FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY CREDITS 3(2+1)

DEPARTMENT: BIOTECHNOLOGY

COURSE OBJECTIVE:

- To understand the plant cell & cell wall and its role in livestock, food and paper industries.
- To study about the Enzymes.
- To study the carbohydrates, nucleotides and nucleic acids and its generation.
- To study about the glycolysis and fatty acid.

Theory

UNIT – 1: Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrates Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides.

UNIT – 2: Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitter ions nature of amino acids; Structural organization of proteins.

UNIT – 3: Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.

UNIT – 4: Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications

UNIT-5: Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids;

Somaclonal variation and its use in crop improvement; cryo-preservation; 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

1. Preparation of solution, pH&buffers, Qualitative tests of carbohydrates and aminoacids.
2. Quantitative estimation ofglucose/proteins.
3. Titration methods for estimation of amino acids/lipids, Effect of pH,
4. Temperature and substrate concentration on enzyme action chromatography TL demonstration for separation of amino acids Monosaccharides sterilization techniques.
5. Composition of various tissue culture media and preparation of stock solutions for MS nutrientmedium.
6. Callus induction from variousexplants.
7. Micro-propagation, hardeningandacclimatization.
8. Demonstration on isolation ofDNA.
9. Demonstration of gel electrophoresis techniques and DNA fingerprinting.

COURSE OUTCOMES

- Knowledge of production of micro-propagation and DNAfingerprinting.
- Knowledge of concepts and applications of plant biotechnology
- Clear understanding of structures ofMonosaccharides

Suggested Readings

Text Books

- Bhojwani, S.S.andM.K.Razdan.1993.PlantTissueCulture: Theoryand Practice. Elsevier Science Publications,Netherlands.

- Chawla, H.S. 2003. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Lewin, B. 2007. Genes IX. Oxford University Press, Inc., New York.
- Conn, E.E and Stumpf, P.K. 1989. *Outline of Biochemistry*. Wiley Eastern Ltd. New Delhi.
- Frank M. Mallette, Paul M. Althouse and Carl O. Glagett. 1960. *Biochemistry of Plants and Animals*. Published by Wiley Western Pvt Ltd., New Delhi
- Jain, J.L. 2001. *Fundamentals of Biochemistry*. 5th Edn. Published by S.Chand & Company, New Delhi
- Lehninger, A. 1984. *Principles of Biochemistry*. Published by CBS Publishers and Distributors, New Delhi Mazur, A and Harrows, B. 1971.

Reference Books

- *Basic Chemistry of Life*. 2nd Edn. Published by Appleton-Century-Crofts, New York.
- *Textbook of Biochemistry*. W.B. Sanders Publications, New Delhi Metha, S.L, Lodha, M.L and Sane, P.V. 1993.
- *Recent Advances in Plant Biochemistry*. Published by ICAR, New Delhi Milton, T. 1920.
- Singh, B.D. 1998. Biotechnology. Kalyani Publications, New Delhi

FUNDAMENTALS OF SOIL SCIENCE CREDITS 3(2+1)

DEPARTMENT: SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

COURSE OBJECTIVES

- To build knowledge and skills in soil science field.
- To study the genesis, classification and morphology, physics, chemistry, fertility and land use.
- To study the soil profile and its components of soil.

Theory:-

UNIT - I Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation.

UNIT - II Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India.

UNIT-III Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth.

UNIT – IV 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 - V Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical:-

1. Study of soil profile in field.
2. Study of soil sampling tools, collection of representative soil sample, its processing and storage.
3. Study of soil forming rocks and minerals.
4. Determination of soil density, moisture content and porosity.
5. Determination of soil texture by feel and Bouyoucos Methods.
6. Studies of capillary rise phenomenon of water in soil column and water movement in soil.

7. Determination of soil pH and electrical conductivity.
8. Determination of cation exchange capacity of soil.
9. Study of soil map. Determination of soil colour.
10. Demonstration of heat transfer in soil.
11. Estimation of organic matter content of soil.

COURSE OUTCOME

- Knowledge of soil profile in field, taxonomy, classification of soils of India.
- Knowledge of soil sampling tools and collection and storage of the representative sample for soil testing.
- Determination of soil reaction which include pH, EC and OC.
- Estimation of soil physical properties, soil texture, structure, density, porosity, soil colour, consistency and plasticity
- Knowledge of soil problems like acidic, saline and alkaline.

Suggested Readings

Text Books

1. The Nature and Properties of Soil (13th Ed.)– Brady, N.C. & Weil, R.R., Macmillan Publishing Co. New York.
2. Soil Physics – Marshall, T.J., Holmes, J.W. & Rose, C.W., Cambridge Univ. Press
3. Text Book of Soil Physics – A.K. Saha, Kalyani Publication, New Delhi
Text Book of Soil Science- Biswas, T.D. and Mukherji, S.K. 1987-TMH
4. Soil, Plant, Water and Fertilizer Analysis – Gupta, P.K. 2007–Agribios

Reference Books

1. Fundamentals of Soil Science – ICAR Publication, New Delhi.
2. Soil Physics – M.C. Oswal, Oxford & IBH Publishing Co.
3. Fundamentals of Soil Science – Foth, H.D. and Turk, L.M.–Wiley

INTRODUCTION TO FORESTRY CREDIT 2(1+1)

DEPARTMENT: AGRO-FORESTRY

COURSE OBJECTIVE:

- To study the silviculture and forest classification.
- To study tending operations- weeding, cleaning, thinning-mechanical, ordinary, crown and advance thinning.

Theory

UNIT – 1 Introduction definitions of basic terms related to forestry, objectives of silviculture, forest classification and salient features of Indian Forest Policies.

UNIT - 2 Forest regeneration, Natural regeneration-from seed and vegetative parts, pollarding, root suckers; artificial regeneration- objectives, choice between natural and artificial regeneration.

UNIT -3 Essential preliminary considerations. crown classification.Tending operations- weeding, cleaning, thinning-mechanical, ordinary, crown and advance thinning. Forest mensuration- objectives, diameter measurement, instruments used India meter measurement.

UNIT - 4 Non instrumental methods of height measurement-shadow and single pole method; Instrumental methods of height measurement geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.

UNIT – 5 Agro-forestry-definitions, importance, criteria of selection of trees in agro-forestry, different agro-forestry systems prevalent in the country, shift in cultivation, taungya alley cropping, windbreaks and shelterbelts, home gardens. Cultivation practices of two important fast growing trees species of the region.

Practical

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

COURSE OUTCOME:

- Gain knowledge of treespecies.
- Knowledge of nursery lay-out forforestry.
- Maintenance of forestproducts.

Suggested Readings

- a. Agriculture Competitive at a Glance, SatyakumariSharma (2017) Kushal Publications and Distributors 1st Edition,2017edition.
- b. Chadha, K.L. and Chowdhury, B, 1992. *Ornamental Horticulture in India*. ICAR NewDelhi
- c. Desai, B.L. 1979. *Planning and Planting of Home Gardens*. Indian Council of Agricultural Research,NewDelhi.
- d. Chadha. K.L. and Gupta. R. 1995. Advance in Horticulture Vol. 11 Medicinal & Aromaticplants. Malhotra Pub. House.,NewDelhi.
- e. Farooqui, A.A., Khan, M.M. and Sreeramu, B.S. 1997. Cultivation of medicinal andaromatic crops in India. NayaPrakash,Kolkatta.
- f. Jain S.K. 1979. Medicinal Plants. National Book Trust of India,NewDelhi.

COMPREHENSION & COMMUNICATION SKILL IN ENGLISH

CREDITS 2(1+1)

DEPARTMENT: LANGUAGE

COURSE OBJECTIVES

- To know the Importance of professional writing.
- To understand Written Skills: Mechanics of good letter, Effective business correspondence, Personal Correspondence.

Theory:-

UNIT-I WarMinusShooting-TheSportingSpirit.ADilemma- Alayman looksatscienceRaymondB. Fosdick. You and Your English – Spoken English and broken EnglishG.B.Shaw.

UNIT-II Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words.

UNIT- III Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration.

UNIT- IV Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing.
The Style: Importance of professional writing.

UNIT-V Preparation of Curriculum Vitae and Job applications.Synopsis Writing.Interviews:kinds, Importance and process.

Practical:-

1. Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general innature).
2. Oral Communication: Phonetics, stress and intonation, Conversation practice.
3. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills

4. Reading dialogues, rapid reading, intensive reading, improving readingskills.
5. Mock Interviews: testing initiative, team spirit, leadership, intellectualability.
6. GroupDiscussions.

COURSE OUTCOME:

- Importance of professionalwriting.
- Knowledge about oral presentation ofreports.
- Understanding readingskills.

Suggested Reading:-

1. Current English for Colleges, By N.Krishnaswamy&T.Sriraman, Macmillan IndiaLimited, Madras,1995;
2. War Minus shooting – The sporting spirit GeorgeOrwell
3. ADilemma–Alaymanlooksat science RaymondB.FosdickYouandYour English Spoken English and Broken EnglishG.B.Shaw

FUNDAMENTALS OF AGRONOMY CREDITS 4(3+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVES

- To study of different operation and practice of ploughing and puddling. Study of seeding equipment and methods of sowing of field crops.
- Study about manures, fertilizers and green manure crops/seeds.
- Study of inter-cultivation practices and methods of fertilizer applications.

Theory:

UNIT-I: Agronomy and its scope, seeds and sowing, tillage and tilth.crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil plant water relationship.

UNIT-II: Crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, waterlogging.

UNIT-III: Weeds- importance, classification, crop weed competition, concepts of weed management- principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

UNIT-IV: Growth and development of crops, factors affecting growth and development, plant ideotypes.

UNIT-V: Crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical:-

1. Identification of crops, seeds, fertilizers, pesticides
2. Tillage implements.
3. Effect of sowing depth on germination and seedling vigour.
4. Identification of weeds in crops.
5. Methods of herbicide and fertilizer application.
6. Study of yield contributing characters and yield estimation.
7. Seed germination and viability test.
8. Numerical exercises on fertilizer requirement.
9. Plant population, herbicides and water requirement.
10. Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill.
11. Study of soil moisture measuring devices.
12. Measurement of field capacity, bulk density and infiltration rate.
13. Measurement of irrigation water.

CORSE OUTCOME

1. Basic knowledge of branches of agriculture.
2. Basic elements of climate and weather required for crop production.
3. Understanding of cultivation process of crops likewise plant geometry.

Suggested Readings Books

Text Books

- Hand Book of Agriculture (2006) -ICAR Publication
- Introduction to Agronomy and soil and water Management - V.G. Vaidya and K.K. Sahatrabudhe
- Agricultural Meteorology - GSLHV Prasad Rao
- Principles and Practices Agronomy-Balsubramaniyan, P and Palaniappan, S.P. 2001 – Agribios
- Climatology - Lal, D.S. (1997), Sharda Pustak Bhawan Publication, Allahabad
- A Practical Guide on Agrometeorology - K.K. Agrawal and A.P. Upadhyay

Reference Books

2. Fundamentals of Agronomy Shiv Kumar G. Telkar, & Shivendu Pratap Singh Solanki
3. Principles of Agronomy - S.R. Reddy (1999), Kalyani Publication, New Delhi
4. Principles of Agronomy Dr. P.K. Singh & IPS Ahlawat
5. Principles of Agronomy & Crops IPS Ahlawat & Omprakash

ELEMENTARY MATHEMATICS CREDITS 2 (2+0)

DEPARTMENT: REMEDIAL COURSES

COURSE OBJECTIVE:

- To able to calculate and analysis data for statisticalanalysis.
- To study distance, circle, angle and differential calculus, matrices anddeterminants
- To study continuity, straight lines and slope-point form of equationoffline.

Theory

UNIT - 1 Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st.lines, Parallel lines Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral.

UNIT – 2 Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx+c$ to the given circle $x^2 + y^2 = a^2$.
.Differential Calculus : Definition of function, limit and continuity, Simple problems on limit

UNIT - 3 Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).

UNIT - 4 Integral Calculus: Integration of simple functions, Integration of Product of Two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

UNIT – 5 Matrices and Determinants: definition of Matrices, Addition Subtraction, Multiplication, Transpose and Inverse up to 3rd Order, Properties of determinates up to 3rd order and their evolution

COURSE OUTCOME

- To able to calculate and analysis data for statistical analysis.
- To able the Addition Subtraction, Multiplication and Transpose.
- To study Straight lines and slope-point form of equation of line also.

Suggested Readings

Text Books

1. Rangaswamy. R. (2002) A text book of Agricultural Statistics. John Wiley (1992) Statistical Methods. Oxford and IBH Publishing Co.& Sons.
2. Balakrishnan. N. (2002) Fisher. R.A. (1950) Statistical Methods for Research Workers-11th Edition.
3. Neerpur, Garg (2016). National council of Educational Research and Training, Class XI, Mathematics.

Reference Books

1. Fundamentals of Elementary Mathematics-Merlyn J. Behr Dale G. Jungst, 2000, Academic Press.
2. Gupta. S.C. and Kapoor. V.K. (1997) Fundamentals of Mathematical Statistics.
3. Sultan Chand & Cochran, W.G. (1989) Sampling Techniques. Oxford and IBH Publishing Co.
4. Snedecor, G.W. and Cochran, W.G. Chakravorthi. S.R. and Giri, N. (2002) Basic Statistics. South Asian Publishers, New Delhi-110 014. Sons Publisher, New Delhi.

INTRODUCTORY BIOLOGY 2(1+1)

DEPARTMENT: REMEDIAL COURSES

COURSE OBJECTIVE:

- To acquire knowledge of Diversity of living organism & Origin of Life
- To study basic knowledge of cellular structures & functions.
- To study morphology of Flowering plants, seeds & general characters of different family of plant kingdom..

Theory

Unit-1 Introduction to the living world, diversity and characteristics of life.

Unit-2 Origin of life, Evolution and Eugenics.

Unit-3 Binomial nomenclature and classification Cell and cell division.

Unit-4 Morphology of flowering plants. Seed and seed germination.

Unit-5 Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

1. Morphology of flowering plants – root, stem and leaf and their modifications.
2. Inflorescence, flower and fruits.
3. Cell, tissues & cell division.
4. Internal structure of root, stem and leaf.
5. Study of specimens and slides.
6. Description of plants - Brassicaceae, Fabaceae and Poaceae.

COURSE OUTCOME:

- Gain knowledge living organism their origin, evolution & diversity
- Knowledge of Functions of cell, Seed & important plant kingdom families of flowering plants.

References

- Hand of biology - Arihant Publication Meerut
- A Class Book of Botany - A.C. Dutta, 2000

- Textbook of Botany - V. Verma, 2009
- College Botany Vol I - Gangulee Das & Dutta 2009
- College Botany Vol II - Gangulee & Kar 2011
- Introductory Botany - Rastogi Publication. Meerut Ashok Bendre and P.C. Pande 1996
- Textbook of Botany Class XI and XII. (2012) - NCERT Publication

AGRICULTURAL HERITAGE CREDITS 1(1+0)

DEPARTMENT: REMEDIAL COURSE

COURSE OBJECTIVE:

- ▪ To study Indian agricultural heritage.
- ▪ To get acquainted journey of Indian agriculture.

Theory:

- UNIT-I** Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture;
- UNIT-II** Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modernera;
- UNIT-III** Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world;
- UNIT-IV** Agriculture scope; Importance of agriculture and agricultural resources available in India;
- UNIT-V** Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospectus

COUSE OUTCOME:

1. Knowledge of crop scenery in India and world
2. Knowledge of national agriculture setup in India.

Suggested Readings

Text Books

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-History 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 Manoharal Publishers Pvt. Ltd,
4. Agriculture Heritage SR Reddy

Reference Books

1. Nene, Y.L., Choudhary, S.L. and Saxena, R.C.2010.Textbook on Ancient History of Indian Agriculture, AsianAgri-HistoryFoundation.
2. D.Kumari, ManimuthuVeeral. 2014. Text Book on Agricultural Heritage of India. AgrotechPublishingAcademy.
3. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research,New Delhi.(<http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf>)

RURAL SOCIOLOGY & EDUCATIONAL PSYCHOLOGY

CREDITS 2(2+0)

DEPARTMENT: AGRICULTURAL EXTENSION AND COMMUNICATION

COURSE OBJECTIVES

- To give in information of Agricultural Extension.
- To understand the such terms of Rural Sociology.
- To understand the such terms Rural leadership.
- To give in information of Educational Psychology.

Theory:-

- UNIT-I** Sociology and Rural sociology: Definition and scope, its significance in agriculture extension.
- UNIT-II** Rural society, Social Groups, Social Stratification, Culture concept, Social Institution.
- UNIT-II** Social Change & Development, Educational psychology: Meaning & its importance in agriculture extension.
- UNIT-IV** Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation.
- UNIT V-** Theories of Motivation, Intelligence.

COURSE OUTCOME

- To understand the different programme of Agriculture Extension
- To study the Sociology and Rural Sociology understand the social structure and social groups.
- To understand the rural leadership.
- To understand the Psychology and Educational Psychology.

Suggested Readings

Text Books

- Raydu, C.S., (1993). Media and Communication Management Himalaya Publishing House, Mumbai.
- Dahama, O.P. and Bhatnagar, O.P. (2003). Education and Communication for Development. Oxford, IBH, New Delhi.
- Ray, G.L. (1991). Extension Communication and Management. Naya Prokash, Calcutta.

Reference Books

- Blun, A. (1996). Teaching and Learning in Agriculture – A Guide for agricultural education, FAO, Rome,
- Chandrakantan, K and Palaniswamy, (2000). Advances in communication Technology, Indian Publishers
- Rogers, E.M. (1983). Diffusion of Innovations. Free Press, New York.

HUMAN VALUE AND ETHICS CREDITS 1(1+0)

DEPARTMENT: NON-GRADIAL COURSES

COURSE OBJECTIVES

- 1) To acquaint the students about various human values needed to become a good human being and a responsible citizen.
- 2) The student will be acquainted with the techniques to attain self awareness and lead a happy and successful life.

Theory:-

UNIT-I : Values and Ethics-An Introduction. Goal and Mission of Life.

UNIT-II: Vision of Life.Principles and Philosophy. Self Exploration. Self Awareness.Self Satisfaction.

UNIT-III: Decision Making.Motivation.Sensitivity.Success.Selfless Service.

UNIT- IV: Case Study of Ethical Lives.Positive Spirit.Body, mind and Soul.

UNIT-V: Attachment and Detachment.Spirituality Quotient.Examination.

COURSE OUTCOME

- 1) After completing this module the students will inculcate various human values and professional ethics.
- 2) Student will be able to take better decisions and lead a happy and successful life.

Suggested Reading:-

Text Books

1. Human values & ethics Maadhuri Joshi-Kalyani Publishers-New Delhi.
2. A text book of professional ethics and human values new age international(C.R.S. Naagarazan.)
3. Professional Ethics and Human Values-M. Govinda-Rajan, PHI Publication.
4. Human Values-Dr. Rajan Mishra-University Science Press.

Reference Books

1. Education & Communication Development Oxford & IBH Publication.
2. Man values & Professional Ethics-Dr. Yogendra Singh AITBS Publishers.

SEMESTER II / FIRST YEAR

Sr. No.	Subject Code	Subject Name	Credits
1	PBG-201	Fundamentals of Genetics	3(2+1)
2	AGM-202	Agriculture Microbiology	2(1+1)
3	SWC-203	Soil and Water Conservation Engineering	2(1+1)
4	FCP-204	Fundamentals of Crop Physiology	2 (1+1)
5	FAE-205	Fundamentals of Agricultural Economics	2 (2+0)
6	FPP-206	Fundamentals of Plant Pathology	4 (3+1)
7	ENT-207	Fundamentals of Entomology	4(3+1)
8	CSP-208	Communication Skill and Personality Development	2(1+1)
9	EXT-209	Fundamentals of Agricultural Extension Education	3 (2+1)
Total Credits			24(16+8)

FUNDAMENTALS OF GENETICS CREDITS 3(2+1)

DEPARTMENT: GENETICS & PLANT BREEDING

COURSE OBJECTIVES

UNIT-I : Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Dominance relationships. gene interaction. Probability and Chi-square.

UNIT- II Cell division- mitosis, meiosis, Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping.

UNIT- III Structural changes in chromosome, Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation.

UNIT- IV Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples. Cytoplasmic inheritance. Genetic disorders.

UNIT- V Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practicals

1. Study of microscope.
2. Study of cell structure.
3. Experiments on monohybrid, dihybrid, trihybrid, test cross and backcross.
4. Experiments on epistatic interactions including test cross and backcross.
5. Practice on mitotic and meiotic cell division.
6. Experiments on probability and Chi-square test.
7. Determination of linkage and cross over analysis (through two point test cross and three point test cross data).
8. Study on sex linked inheritance in *Drosophila*.
9. Study of models on DNA and RNA structure.

COURSE OUTCOME:

- Familiarity with Quantitative traits and Qualitative traits. Knowledge improvement of Cytoplasmic inheritance.
- Basic understanding of chromosome structure, morphology, Karyotype and Idiogram. Understanding the numerical chromosomal aberrations (Polyploidy) and evolution.
- Knowledge of Gene expression regulation and differential gene activation.

Suggested Readings Books:-

- Singh, B.D. 2017, Fundamentals of Genetics, Kalyani Publishers
- Gardener E.J. & Shustad D.P. 1991, Principles of Genetics, John Wiley & Sons
- Strickberger M.W. 2005 Genetics (III Ed) Prentice Hall New Delhi, India
- Gupta P.K. 2002, Genetics, Rastogi Publications
- Singh, B.D. Pre 2017, Principles of Genetics, Kalyani Publishers

AGRICULTURAL MICROBIOLOGY CREDITS 2(1+1)

DEPARTMENT: MICROBIOLOGY

COURSE OBJECTIVE:

- To understand the History of microbiology
- To study about the genetic engineering
- To understand the soil microbiology
- To understand the plant microbe interaction-PGPR

Theory

UNIT-I Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemo autotrophy, photo autotrophy, growth.

UNIT-II Bacterial genetics: Genetic recombination-transformation, conjugation and transduction, plasmids, transposon.

UNIT - III Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and sulphur cycles.

UNIT - IV Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and bio degradation.

UNIT-V Biological nitrogen fixation- symbiotic, associative and a symbiotic, Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere.

Practical

- Introduction to microbiology laboratory and its equipments;
- Microscope- parts, principles of microscopy, resolving power and numerical aperture.

- Methods of sterilization. Nutritional media and their preparations.
- Enumeration of microbial population in soil- bacteria, fungi, actinomycetes.
- Methods of isolation and purification of microbial cultures.
- Isolation of Rhizobium from legume root nodule.
- Isolation of Azotobacter from soil.
- Isolation of Azospirillum from roots.
- Staining and microscopic examination of microbes.

COURSE OUTCOME:

- Information about soil microbiology.
- Understanding plant microbe interactions.
- Metabolism and nutrition in bacteria.
- Knowledge of food preservation

Suggested Readings Books:-

- Fundamental of Agriculture microbiology ,Author K.R. Areya, Publication New Age International Private Limited
- Agriculture Microbiology Byy – Author Name- Publication Prentice Hall India Learning Private Limited
- Agriculture Microbiology, Author Name B.P. Singh, Kalyani Publication Language Hindi
- Soil Microbiology – Dr. Singh. T. Pr. Purohit
- Microbiology for Nurses - Publisher Agrobios (India) Language – English Dr. A.T.T.B. Pub. India.

SOIL AND WATER CONSERVATION ENGINEERING

CREDITS 2(1+1)

DEPARTMENT: AGRICULTURAL ENGINEERING

COURSE OBJECTIVES

- To study about Soil and water conservation.
- Understand the Soil erosion and water erosion with the help of Soil loss equation.
- To understand the Soil and water conservation management in India.
- To calculate the Soil loss measurement with management.
- Design of graded bund and contour bunds.
- To estimate the different types of Soil erosion with types and management.

Theory:-

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

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

UNIT- III Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design.

UNIT-IV Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement.

UNIT-V Principles of wind erosion control and its control measures

Practical:-

1. General status of soil conservation in India.
2. Calculation of erosion index.
3. Measurement of soil loss.
4. Preparation of contour maps.
5. Design of grassed waterways.
6. Design of contour bunds.
7. Design of graded bunds.
8. Design of bench terracing system.
9. Problem on wind erosion.
10. Estimation of soil loss.

COURSE OUTCOME:

- To understand different types of soil and water conservation methods

Suggested Readings

- Principles of Agricultural Engineering Vol. II – Dr. A.M. Michael and Dr.T.P.Ojha
- Ojha, T.P. and A.M. Michael. *Principles of Agricultural Engineering*, Vol.I. Jain Brothers New Delhi. 3rd Edition 2001
- Ojha, T.P. and A.M. Michael. *Principles of Agricultural Engineering*, Vol.II. Jain Brothers New Delhi 3rd Edition 2001
- Sahay, Jagdiswar. *Elements of Agricultural Engineering*. Agro book Agencies, 1977
- Singhal, O.P. *Agricultural Engineering* 1977

Reference Books

- Mukund Narayan Satyendra Kumar, Nilesh Biwalkar, Reference Manual Of Soil & Water Conservation Engineering, 2014
- Suresh R, Soil & Water Conservation Engineering, 2018

FUNDAMENTALS OF CROP PHYSIOLOGY CREDITS

2(1+1)

DEPARTMENT: PHYSIOLOGY

COURSE OBJECTIVES

- To understand the seed structures and seed physiology
- To study the growth and development C3, C4 and CAM plants.
- To study the function of plant tissues
- To study the types of seed dormancy.

Theory:-

- UNIT-I** Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology.
- UNIT-II** Mineral nutrition of Plants: functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.
- UNIT-III** Photo synthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: glycolysis, TCA cycle and electron transport chain; Fat Metabolism: fatty acid synthesis and Breakdown.
- UNIT-IV** Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops:
- UNIT-V** Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical:

1. Study of plant cells, structure and distribution of stomata.
2. Imbibition, osmosis, plasmolysis, measurement of root pressure.
3. Rate of transpiration, Separation of photosynthetic pigments through paper chromatography.
4. Rate of transpiration, photosynthesis, respiration,
5. Tissue test for mineral nutrients, estimation of relative water content,
6. Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

COURSE OUTCOME

- To understand seed structure and seed physiology.
- To understand the seed germination and purity percentage of seed.

Suggested Readings Books:-

Text Books

- Bidwil R.G.S. Plant Physiology II End. Macmillan, Publishing Co., Inc. New York
- Salisbury, F. B. & Ross. C.W. Plant Physiology, CBS Publishers & Distributors, New Delhi
- Crop Physiology by G.C. Srivastava By – Biotech Books
- Fundamentals of Plant Physiology Dr. V.K. Jain – Chand Publication

Reference Books

- Noggle G.R. & Fritz G.J. 1992. Introductory Plant Physiology II End. Prentice Hall of India(P) Ltd., New Delhi
- Plant Physiology by S.N. Pandey & B.K. Sinha Published by – Vikas Publishers

FUNDAMENTALS OF AGRICULTURAL ECONOMICS

CREDITS 2(2+0)

DEPARTMENT: AGRICULTURAL ECONOMICS

COURSE OBJECTIVES

- To give an information of different terminology of Agricultural Economics.
- To learn the various kinds of human wants, demand & supply.
- To understand the such terms of Economics - Goods, Services, Value, Price & Consumer surplus etc.
- To understand an Indian Economy such as National Income, GDP, GNP etc.

Theory:-

UNIT - I Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; Micro and Macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, Concept of equilibrium, economic laws as generalization of human behavior .

UNIT - II Basic concepts: Goods and services, desire, want, demand, utility, cost and price. wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

UNIT III Demand: meaning, law of demand, demand schedule and demand curve, determinants. utility theory; law of diminishing marginal utility, equi-marginal utility principle. consumer's equilibrium and derivation of demand curve, concept of consumer surplus. elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves.

UNIT IV Supply: Stock v/s supply, law of supply, 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. 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 socio-economic determinants, current policies and programmes on population control.

UNIT - V Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. 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. T .Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

COURSE OUTCOME

- To understand different types of activity of Economics & Agricultural Economics.
- To understand the importance & scope of Agricultural Economics
- Find the cost of cultivation & cost of production
- To obtain information on Indian Agricultural Economics.

Suggested Readings Books:-

- Kenneth, E.B.1941. *Economic Analysis*. Harper and Row, New York.
- Reddy, S., Raghuram, P., Neelakantan, T.V., Bhavani D.I.2004.
- *Agricultural Economics*. Oxford and IBH Publishers, New Delhi.
- *Agricultural Economics* By – S. Subba Reddy P. Raghuram Reddy
- *Indian Economy* , By-Misra E- Puri , Himalaya Publication published by oxfordE-IBH
- *Principles of Economics* By – Dr. D.M. Mithani Published by Himalaya Publication
- *Agricultural Economics* By – R.K. Lekhi Joginder Singh. Published by Kalayani

Reference Books

- Instant Social Science By – Vikash Pawariya. Published by – KushalPublication
- Principles of Economics By –M.L.Jhingan
- Jhingam, M.L.2001. *Micro Economic Theory*. Konark publishers, NewDelhi.
- Ahuja H.L. 2015. Macro economics theory & policy. S.Chand&comp.Ltd.
- Ahuja H.L. 2015. Principles of microeconomics. S.Chand&comp.Ltd.

FUNDAMENTALS OF PLANT PATHOLOGY 4(3+1) COURSE CODE: ABPP-201

Course Objective

- To identifying the important disease causal organisms of plant.
- Study on phenomenon of infection like pre penetration, penetration and postpenetration.
- Study on common laboratory techniques in mycology, preservation and plant disease specimens.
- Study on symptoms, host parasite relationships and systematic position of plant disease causal organisms.

Theory:

UNIT-1 Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plantdiseases.

UNIT-2 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

UNIT -3 Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders andclasses.

UNIT-4 Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.)

UNIT -5 Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens.Types of parasitism and variability in plant pathogens.Pathogenesis.Role of enzymes, toxins and growth regulators in disease development.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:

1. Acquaintance with various laboratory equipments and microscopy.
2. Collection and preservation of disease specimen.
3. Preparation of media, isolation and Koch's postulates.
4. General study of different structures of fungi.
5. Study of symptoms of various plant diseases.
6. Study of representative fungal genera.
7. Staining and identification of plant pathogenic bacteria.
8. Transmission of plant viruses.
9. Study of phanerogamic plant parasites.
10. Study of morphological features and identification of plant parasitic nematodes.
11. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.
12. Study of fungicides and their formulations.
13. Methods of pesticide application and their safe use.
14. Calculation of fungicide sprays concentrations.

COURSE OUTCOME:

- To get Knowledge about various types of plant pathogens.
- Information on pathogenicity, pathogenesis and infection, its related symptoms.

Suggested Readings Books:-**Text Books**

- Introduction to Principles of Plant Pathology -R.S.Singh
- Plant Pathology -R.S.Mehrotra
- A text book of modern Plant Pathology - Bilgramie and Dubey
- Introductory Plant Pathology -M.N.Kamath
- Plant Diseases -P.D.Sharma
- Plant Pathology (R.P. Singh) Kalyani Publishers
- Plant Pathology A competitive Vision (Satvinder Kaur Mann)
- A Textbook of Plant Pathology (A.V.S.S. Sambamurty) Kalyani Publishers
- Plant Pathology – B.P. Singh Rama Publishers

Reference Books

- Plant Pathology - E.N. Agrios– Academic Press
- Plant Pathology At A Glance (Utpal Kumar Bhattacharyya) Kalyani Publishers
- Fungi and Bacteria, Virus –(A.S.C.Dubey)
- Essentials of Plant Pathology - V.N.Pathak

FUNDAMENTALS OF ENTOMOLOGY CREDITS 4(3+1)

DEPARTMENT: ENTOMOLOGY

COURSE OBJECTIVES

- Studies on relationship of insect with crop plants and humans life.
- To identifying insect behavior and damaging stages.
- Study on insect collection and preservation methods.
- Studies on systematic classification importance, history, development and Binomial nomenclature.

Theory:-

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

UNIT- II Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem.

UNIT- III Pest surveillance and pest forecasting. Categories of pests. Host plant resistance, Cultural, Mechanical, Physical. Legislative. Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) methods of control. Chemical control-importance,

hazards and Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers, their importance.

UNIT- IV Systematics: Taxonomy –importance, history and development and binomial nomenclature.

Definitions of Biotype, Sub-species, Species, Genus, Family and Order.

UNIT- V Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis

to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae,

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

Practical:-

1. Methods of collection and preservation of insects including immature stages.
2. External features of Grasshopper/Blister beetle.
3. Types of insect antennae, mouthparts and legs.
4. Wing venation, types of wings and wing coupling apparatus.
5. Types of insect larvae and pupae.
6. Dissection of digestive system in insects (Grasshopper).
7. Dissection of male and female reproductive systems in insects (Grasshopper).
8. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera.
9. Diptera and their families of agricultural importance.

COURSE OUTCOME:

- Be able to relationship of biotic and a biotic factor in insect lifecycle
- Be able to design basic statistical analyses and evaluate statistical information of insect forecasting
- Be able to apply and judge the scientific method of pest control in the laboratory and in the field
- To understand of the primary literature in entomology and be able to critically evaluate information in primary research articles
- Be able to apply actual doses of insecticides to maintain pesticides hazards, environmental pollutions and soil pollutions.
- To be able to examine insects deeply within a biological level of analysis and compare strategies used by different groups

Suggested Readings Text Books

- General textbook of Entomology Vol 1 & 2 – Richards, O.W. and Davies, R.G. Chapman and Hall Publication London.
- Text Book of Entomology – Pruthi, H.S.
- Agricultural Entomology for Indian Students – Khanna, S.S.
- General and Applied Entomology – Nayar, K.K., Ananthkrishnan, T.N. and David, B.V. - TMH
- The Insect - Structure and function – Chapman, R.F. 1981 Edward Arnold Publishing Limited London

Reference Books

1. Applied Entomology K.P. Shrivastava
2. General Entomology Dr. Mathur and Uppadhyay
3. Hand Book of Entomology T. V. Prasad
4. South east asiatic crop pest and their Management A.S. Atwal and G.S. Dhaliwal
5. Applied Entomology D.S. Reddy

COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT CREDITS 2(1+1)

DEPARTMENT: Agricultural Extension and Communication

COURSE OBJECTIVE:

1. To inculcate the skills of proper and effective communication instudents.
2. Todevelopaneffectiveandmagneticpersonalityessentialforfacingcompetitionafterstudies and in life.

Theory

UNIT-1: Communication, meaning and process of communication, Listening and note taking skills, writingskills

UNIT-2: Nature of communication, objectives, Functions, and importance of communication Oral presentation skills, field Diary and Lab recordPreparation

UNIT-3: Principles of communication, advantages, Effective communication system. Seven “cs” of efficient communication, indexing, Foot notes Verbal and Non verbal communication.

UNIT-4: Personality Elements of Personality Benefits ofpersonalitydevelopment ,Reading and comprehension of articles, precise writingsummarizing

UNITS-5: Developing effective personality personal communication skills, grouppresentation, public speaking, group discussions, organizing seminars andconferences.

Practical –

- Listening and note taking skills
- Writing skills, Letter writing
- Oral presentation skills
- Preparing field Diary and Lab record
- Indexing Footnote and bibliographic procedures
- Reading and comprehension of general & technical articles
- Precise writing,summarizing
- Individual and group presentation
- Public speaking
- Group discussion
- Organizing seminars and conferences

COURSE OUTCOME

- After completing this course the students will develop excellent verbal and non-verbal communication skills, and will be having an effective personality full of confidence to face the

challenges of life.

- Developing effective personality personal communication skills.

Books recommended

Text Books

1. A simple approach to communication skills-Dr. Neha Mathur and V. K. Mathur – (ISBN- 13: 978-93-84754-1-5) Mausam Books, J.K. Jain Brothers, Bhopal at 462001
2. How to win friends and influence people – Dale Carnegie
3. How to communicate effectively-Ashish Singh ISBN – 978-1-4828-1919-9 (Partridge India)

Reference Books

1. The Dynamics of personality development J.R. Bhatti

FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION CREDITS 3 (2+1)

DEPARTMENT: AGRICULTURAL EXTENSION & COMMUNICATION

COURSE OBJECTIVES

- To understand Agricultural Extension.
- To study Rural Sociology.
- To understand rural leadership.
- To gain formation of educational psychology.

Theory:-

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

UNIT - IV Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes. Transfer of technology: concept and models, capacity building of extension personnel.

Extension teaching methods: meaning, classification, individual, group and mass contact

methods, media mix strategies;

UNIT–V communication: meaning and definition; models and barriers to communication., Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical:-

1. To get acquainted with university extension system.
2. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector.
3. preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories.
4. Presentation skills exercise; micro teaching exercise.
5. A visit to village to understand the problems being encountered by the villagers/farmers.
6. To study organization and functioning of DRDA and other development departments at district level.
7. 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.
8. Visit to community radio and television studio for understanding the process of programme production.
9. Script writing, writing for print and electronic media, developing script for radio and television.

COURSE OUTCOME

- To understand the different programmes of Agriculture Extension
- To study the Rural Sociology and understand the social structure and social groups.
- To understand the rural leadership.

Suggested Readings Books:-

- Education and communication for development - O.P. Dahama and O.P. Bhatnagar Pub.– I.B.H. New Delhi
- Reddy. A.A. (1987). Extension Education. Sree Lakshmi Press. Bapatla.
- Extension communication and management - GL. Ray Pub. Naya Prokash Calcutta.

Reference Books

- Blun, A. (1996). Teaching and Learning in Agriculture – A Guide for Agricultural Education, FAO, Rome.
- Rogers, E.M. (1983). Diffusion of Innovations. Free Press, New York.
- Lesche, R. (1997). How to write, speak and think more effectively. Happer & Row, New York.

SEMESTER III / SECOND YEAR

S. No.	Subject Code	Subject Name	Credit
1.	ABAG 302	Crop Production Technology (<i>Kharif Crop</i>)	2(1+1)
2.	ABGP 302	Fundamentals of Plant Breeding	3(2+1)
3	ABEC 302	Agricultural Finance and cooperation	3(2+1)
4	ABIT 301	Agriculture Informatics	2(1+1)
5	ABAE 302	Farm Machinery and Power	2(1+1)
6	ABHO 302	Production Technology of Vegetables and spices	2(1+1)
7	ABES 301	Environmental Studies and Disaster Management	3(2+1)
8	ABST 301	Statistics Method	2(1+1)
9	ABAH 301	Livestock and Poultry Management	4(3+1)
Total Credit			23 (14+9)

CROP PRODUCTION TECHNOLOGY-I (KHARIF CROPS)

CREDITS 2(1+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- To identify and familiarize cereals, millets, tuber crops and forage crops.
- To study the familiarization of different silos, silage making and haymaking
- To calculate the seed rate, fertilizer requirements and cost of cultivation of major crops.

Theory

UNIT-I Cereals – rice, maize, sorghum, pearl millet and finger millet.

UNIT-II Pulses- pigeon pea, mungbean and urdbean.

UNIT-III Oilseeds- groundnut and soybean.

UNIT-IV Fibre crops- cotton & Jute.

UNIT-V Forage crops-sorghum, cowpea, cluster bean and Napier grass.

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Practicals

1. Rice nursery preparation, transplanting of Rice.
2. Sowing of soybean, pigeon pea, mungbean, maize, groundnut and cotton.
3. Effect of seed size on germination and seedling vigour of kharif season crops.
4. Effect of sowing depth on germination of kharif crops.
5. Identification of weeds in kharif season crops.
6. Top dressing and foliar feeding of nutrients.
7. Study of yield contributing characters and yield calculation of kharif season crops.
8. Study of crop varieties and important agronomic experiments at experimental farm.
9. Study of forage experiments.
10. Morphological description of kharif season crops,
11. Visit to research centres of related crops.

COURSE OUTCOME

- Knowledge of economic and geographical distribution of field crops.
- Knowledge of cultivation practices of field crops.
- Knowledge about best practices of cultivation.

Suggested Readings

Text Books

- Chatterjee, B.N. 1989. *Forage Crop Production- Principles & Practices*. Oxford & IBH New Delhi.
- Chatterjee, B.N. and Maiti, S. 1985. *Principles and Practices of Rice Growing*. Oxford & IBH Publishing Co., New Delhi.
- ICAR [Indian Council of Agricultural Research]. 2006. *Hand Book of Agriculture*. ICAR, New Delhi
- Mohankumar, C.R., Nair, G.M. James George, Raveendran. C.S. and Ravi. V. 2000. *Production Technology of Tuber Crops*. C.T.C.R.I, Trivandrum
- Narayanan, T.R. and Dobadghao, P.M. 1972. *Forage Crops of India*, ICAR, New Delhi.
- Onwueme, I. C. and Charles. W.D. 1994. *Tropical Root and Tuber Crops – Production, Perspective and Future Prospects*. F.A.O. Production and Protection Paper-126, Rome.
- Pal, M., Deka, J., and Rai, R.K. 1996. *Fundamentals of Cereal Crop Production*. Tata McGraw Hill Pub., New Delhi

Reference Books

- Prasad, R. (Ed.). 2001. *Field Crop Production*. ICAR, New Delhi
- Modern Techniques of Raising field Crops Chhida Singh & Prem Singh
- Das, P.C. 1997. *Oilseed Crops of India*, Kalyani Publishers., New Delhi. ICAR [Indian Council of Agricultural Research]. 2006. *Hand Book of Agriculture*. ICAR, New Delhi
- Chhida Singh, Prem Singh and Rajbir Singh. 2003. *Modern Techniques of Raising Field Crops* (2nd ed.). Oxford & IBH, New Delhi.
- Kharif Crop Production RL Arya & Keshv Arya

FUNDAMENTALS OF PLANT BREEDING

CREDITS 3(2+1)

DEPARTMENT: GENETICS AND PLANT BREEDING

COURSE OBJECTIVE:

- To study the different principles of plantbreeding.
- To gain knowledge about different breedingmethods.

Theory

UNIT - I Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self- incompatibility and male sterility- genetic consequences, cultivaroptions.

UNIT – II Domestication, Acclimatization, introduction; Centre of origin/diversity, component 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 - III Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection andhybridization.

UNIT - IV Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding- methods and uses; Breeding for important biotic and abiotic stresses.

UNIT - V Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer’s Rights.

Practical

1. Plant Breeder’s kit, Study of germplasm of variouscrops.
2. Study of floral structure of self-pollinated and cross pollinatedcrops.
3. Emasculation and hybridization techniques in self & cross pollinatedcrops.
4. Consequences of inbreeding on genetic structure of resultingpopulations.
5. Study of male sterilitysystem.
6. Handing of segregationpopulations.

7. Methods of calculating mean, range, variance, standard deviation, heritability.
8. Designs used in plant breeding experiment, analysis of Randomized Block Design.
9. To work out the mode of pollination in a given crop and extent of natural outcrossing.
10. Prediction of performance of double cross hybrids.

COURSE OUTCOME

- Understand the various genetic principles and procedures of crop improvement.
- Knowledge gained about modes of reproduction for deciding various genetic improvement aspects of crop species.
- Be familiar with the principles and methods of various plant breeding methods.
- Gaining knowledge about various plant genetic resources.
- Knowledge gained about evaluate the economic importance of various crops with plant breeding point of view.

Suggested Readings Books:-

Text Books

- Breeding of Crop Plant – Hayes & Garber
- Plant Tissue culture & Biotechnology – P.C. Trivedi
- Principles & procedures of Plant Breeding – G.S. elahal
- Essentials of Plant Breeding – Phundan Singh
- Padap Prajanan (Hindi) – Dr. Chandra Prakash Shukla
- Phasal Prajanan Ke Mool Siddhant (Hindi) – Dr. Hari Ram

Reference Books

- Alard, R.W. 2000. Principles of Plant Breeding. John Wiley & Sons, New York.
- Chahel, G.S. and S.S. Ghosal. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
- Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
- Singh, P. 2001. Essentials of Plant Breeding- Principles and Methods. Kalyani Publishing House, New Delhi.
- Jain, H.K. and M.C. Kharkwal. 2004. Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
- Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.

AGRICULTURAL FINANCE AND CO-OPERATION

C R E D I T S 3(2+1)

DEPARTMENT: AGRICULTURAL ECONOMICS

COURSE OBJECTIVE:

- To give an information about finance and credit.
- To understand the different commercial banks with function and activities.
- To find out the procedural formalities in sanctioning of farm loan.
- To identify the credit needs and classification.
- To give an information about accounting, banking, KCC and kinds of loan etc.

Theory

UNIT - I 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 – II Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India.

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

UNIT - V 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 and NAFED.

Practicals

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

COURSE OUTCOME

- Clear understanding agric. finance & credit
- Knowledge the different commercial banks, RRB & NABARD bank activity.
- Understanding the need & classification of credit
- Clear understand the different types of credit & credit analysis like 3“R”, 5 „C” & 7P”s
- Knowledge the nationalization of commercial bank.
- To understand the higher financing agencies such as RBI, ADB (Asian development bank), World bank, insurance

Suggested Readings Books:-

Text Books

- Kahlon, A.S., Singh, Karam. *Managing Agricultural Finance*. Allied Publishers, New Delhi
- Reddy, S., Raghuram, P., Neelakantan, T.V and Bhavani D.I. 2004. *Agricultural Economics*. Oxford and IBH Publishers, New Delhi.

Reference Books

K Nirmal Ravi Kumar, Objective Agricultural Economics. Astral Publication.

AGRICULTURAL INFORMATICS CREDITS 2(1+1)

DEPARTMENT: COMPUTER APPLICATION

COURSE OBJECTIVE:

- To understand agricultural informatics and its classification.
- Understanding concepts of Operating Systems-DOS and WINDOWS computers.
- To study word processing and other programs of MS-Office.

Theory

UNIT - I Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types. Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, tabulation and graph creation, statistical analysis mathematical expressions,

UNIT-II Database, concepts and types, creating database, uses of DBMS in

Agriculture, Internet and World Wide Web (WWW), Concepts and components. Computer Programming, General Concepts, Introduction to Visual Basic, Java, Fortran, C/ C++, etc, concepts and standard input/output operations.

UNIT - III E-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, inputs- outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation.

UNIT – IV IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information.

UNIT - V Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, and Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.

Practical

- Study of Computer Components, accessories, practice of important DOS Commands.
- Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.
- Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document.
- MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros.
- MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.
- Introduction to World Wide Web (WWW) and its components.
- Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/CropSyst/Wofost.
- Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools.
- Use of smart phones and other devices in agro-advisory and dissemination of market information.
- Introduction of Geospatial Technology, for generating information important for Agriculture.
- Hands on practice on preparation of Decision Support System. Preparation of contingent crop planning.

COURSE OUTCOME

- Basic knowledge of computer and agricultural informatics.
- Perfection in practicing WINDOWS Operating Systems and other agriculture informatics software and devices

Suggested Readings Books:-

- Gene Wrisskpof (1998) ABC's of Excell
- Sharma K.V.S. (2001) Statistics made simple: Do it yourself on PC. Prentice Hall of India.
- Capron. H.L. (1996) Computers – Tools for an information age – Fourth Edition. The Benjamin / Cummings Publishing Company, Inc., New York.
- Colin Haynes. (1990). The Computer Virus Protection Handbook. BPB Publications, New Delhi.
- Peter Nortons. (2001) Introduction to Computers – Fourth Edition. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
- Ruth Maran (1999) Teach yourself MS Office visually. IDG Books Worldwide Inc., New York.

- Fundamental of Computer- P.K.Sinha
- M.S. Office – NitinkNagle
- Computer Fundamental - NitinkNagle
- Management of Information Systems - GordonB.Davis
- Microcontrollers, Principles and Applications – Ajitpal – PHI Ltd.,-2011.
- Willem Zip. Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology. The WorldBank, Washington
- Meera SN. ICTs in Agricultural Extension: TacticaltoPractical
- R Saravanan, C Kathiresan& T Indra Devi, 2011. Information & communication technology for agriculture and rural development. New IndiaPubl.Agency.

Referece Books

- R Saravanan 2010. ICTs for agricultural extension, New IndiaPubl.Agency.
- B Jirli, Deepak De & GC Kendadamth 2005. Information and communication technology (ICT) and sustainable development, Ganga Kaveri Publ.House,Varanasi.

FARM MACHINERY AND POWER CREDITS 2(1+1)

DEPARTMENT: AGRICULTURAL ENGINEERING

COURSE OBJECTIVE:

- To study Human, Animal, Mechanical and Electrical Energy Sources and their in Agriculture.
- Two Stroke and Four stroke engine working Principle.
- To study different system of I.C. Engine and Cooling System.
- Sourcing method seed cum fertilizer drills component and function.
- To study primary tillage and secondary and tillage equipment E.T.C
- Harvesting tools and equipment and combine harvesting machinery.

Theory

UNIT-I 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, Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines.

UNIT - II 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 and attached implement.

UNIT – III Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations.

UNIT-IV Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples.

UNIT-V Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

- Study of different components of I.C. engine.
- To study air cleaning and cooling system of engine. Familiarization with
 - 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, Implements for hill agriculture, Familiarization.
 - With different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow.
 - Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration.

- □ Planters and transplanter familiarization with different types of sprayers and dusters. □ Familiarization with different inter-cultivation equipment.
- □ Familiarization with harvesting and threshing machinery.

COURSE OUTCOME

- □ Knowledge of agricultural machineries.
- □ Knowledge of equipments used in organic and inorganic farming.

Suggested Readings Books:-

- Ojha, T.P. and A.M. Michael. *Principles of Agricultural Engineering*, Vol.I. Jain Brothers New Delhi. 3rd edition 2001.
- Sahay, Jagdiswar. *Elements of Agricultural Engineering*. Agro book Agencies 1977 Singhal, O.P. *Agricultural Engineering*, 1977

Reference Books

- Principles of Farm Machinery” by Kepner
- Agricultural Mechanics: Fundamentals and Applications” by Ray V Herren

PRODUCTION TECHNOLOGY FOR VEGETABLE AND SPICES

CREDITS 2(1+1)

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVE:

- To give the basic knowledge and cultivation of spices crops and medicinal crops and aromatic crops and plantation crops.
- To give the knowledge based on different type classification in spices crops, medicinal crops and aromatic crops and plantation crops.

Theory

- UNIT-I** Importance of vegetables & spices in human nutrition and nationaleconomy.
- UNIT-II** Brief about origin, area, production of vegetable andspices.
- UNIT-III** Improved varieties and cultivation practices such as time of sowing, sowing transplanting techniques, planting distance, fertilizer requirements, irrigation of vegetable andspices.
- UNIT-IV** Weed management, harvesting, storage, physiological disorders of vegetable andspices.
- UNIT-V** Disease and pest control and seed production of important of vegetable andspices.

- Practical**
- Identification of vegetables & spices crops and theirseeds.
 - Nurseryraising.
 - Direct seed sowing andtransplanting.
 - Study of morphological characters of different vegetables &spices.
 - Fertilizersapplications.
 - Raising of nursery of vegetables &spices.
 - Vegetables & spices seedextraction.
 - Harvesting & preparation formarket.
 - Economics of vegetables and spicescultivation.

COURSEOUTCOME:

- To give knowledge about the production technology of spices, medicinal and aromaticplants.
- To give knowledge about the site selection of nursery and theirmanagement

Suggested Readings Books:-

Text Books

- Choudhury, B.1983. Vegetables. National Book Trust, NewDelhi.
- Das, P. C.1993. Vegetable crops in India. KalyaniPublishers

- Gopalakrishnan, T. R. 2007. Vegetable Crops. New India Publishing Agency, NewDelhi.
- Kallo, G. Tomato. Allied Publishers Pvt.Ltd.
- Peter, K. V. 1998. Genetics and Breeding of vegetables. ICAR, NewDelhi.
- Thamburaj, S. and Singh, N. 2005. Vegetables, tuber crops and spices. ICAR, NewDelhi.

Reference Books

- Vegetable Growing S.C.Dey
- A₂Z Solution Vegetable, Spices and Condiments Dr. A.S.Salariya
- Vegetable Science Neeraj PratapSingh
- Hazra,P.andSom,M.G.1999.TechnologyforvegetableProductionandImprovement.Naya Prokash,Calcutta
- Bose, T. K. and Som, M. G. 1990. Vegetable crops in India. Naya Prokash,Calcutta.
- Chadha, K. L. 2003. Handbookof Horticulture, ICAR, NewDelhi.

ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

CREDIT 3(2+1)

DEPARTMENT: ENVIRONMENTAL SCIENCES

COURSE OBJECTIVE:

□ To study the importance of environmental science and ecosystem. □

To study about environmental pollution and disaster management.

Theory

Unit - I Renewable and non-renewable resources, Natural resources and associated problems Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources. a) Forest resources: Use and over-exploitation, deforestation, case studies. lifestyles. problems, water logging, salinity, case studies. e) Energy resources: Growing energy Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, resources for sustainable needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide

UNIT – II Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, food webs and ecological pyramids. Introduction, types, characteristic features, structure and consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert India. Conservation of

biodiversity: In-situ and Ex-situ conservation of biodiversity. Diversity and bio geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem

UNIT – III Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. industrial wastes. Role of an individual in prevention of pollution. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban awareness.

UNIT - IV Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public problems related to energy, Water conservation, rain water harvesting, watershed management. Human Population and the Environment: population growth, variation among nations, population Environment and human health. Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in explosion, Family Welfare Programme. Environment and human health: Human Rights, Value

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

Practical

- Pollution case studies. CaseStudies-Fieldwork:
- Visit to a local area to document environmental.
- Ecosystems-pond, river, hill slopes, etc.
- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple assets river/ forest/grassland/hill/mountain.
- Visit to a local polluted site

COURSE OUTCOME

- Knowledge about management of flood, earth quack, cyclone and landslides
- To knowledge about how to control the pollution.
- This subject provides the knowledge about the Indian Acts of environment protection

Suggested Readings Books:-

- Hodges, L. 1973. *Environmental Pollution*. 2nd Edn. Holt, Rinehart and Winston, USA
- Gupta, A.K. 2007. *Methods in Environmental Analysis Water, Soil and Air*. 2nd Edn. Published by AGROBIOS (India) Jodpur
- Purohit, S.S. 2006. *Environmental Pollution Causes, Effects and Control*. Published by AGROBIOS (India) Jodpur
- Salt, D.E, Smith, R.D. and Ruskin, I. 1998. *Phyto Remediation*. Annu Rev. Plant Physiol. Plant Mol. Biol. 49 : 643 -68.
- Sehgal, J.L. & Absol, I.P. 1994. *Soil Degradation in India, Status and Impact*. Oxford and IBH publishing Co., New Delhi
- Rathore N.S., Panwar N.L., Kurchania A.K., *Renewable Energy Theory & Practice*, (2008), Himanshu Publications, New Delhi. ISBN 9788179061282
- Rathore NS, Panwar NL, Kurchania AK, *Renewable Energy Theory & Practice*, (2006), ISBN 9788179061282, Himanshu Publications, New Delhi,
- Rathore N.S., Panwar N.L., Kurchania A.K., *Non Conventional Energy Sources*, (2007), pages 355. ISBN 9788179061664 Himanshu Publications, New Delhi.

Reference Books

- Alloway, A.J. 1990. *Heavy metals in soils*. John Wiley & Sons, New York.
- Banerji, S.K. 1993. *Environmental Chemistry*. Prentice Hall of India Pvt. Ltd, New Delhi
- Briggs, D and Courtney, F. 1993. *Agriculture and Environment. The Physical Geography of Temperate Agriculture System*. Longman, London
- Filter, A.H. and Hay, R.K.M. 1987. *Environmental Physiology of Plants*. 2nd Edn. Academic Press, London

STATISTICAL METHODS CREDITS 2(1+1)

DEPARTMENT: AGRICULTURAL STATISTICS

COURSE OBJECTIVE:

- Functions of statistics and collection of statistically data
- To understand the sample survey.
- Knowledge of frequency distribution and measures of dispersion

Theory

UNIT - I Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof).

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

UNIT III Linear Regression Equations. Introduction to Test of Significance, One sample & Two sample test t for Means, Chi-Square Test of Independence of Attributes in 2x2 Contingency Table.

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

UNIT – V Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

- Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles.
- Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles.
- Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of skewness & Kurtosis (Ungrouped Data).
- Moments, Measures of skewness & Kurtosis (Grouped Data).
- Correlation & Regression Analysis. Application of One Sample t-test.
- Application of two Sample Fisher's t-test.
- Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2x2 contingency table.

- Analysis of Variance One Way Classification.
- Analysis of Variance Two Way Classification.
- Selection of random sample using Simple Random Sampling.
-

COURSE OUTCOME

- Enhanced Collection of Statistical Data. Formation of Frequency Distribution.
- Improvement in the Information about Sampling, Sampling Distribution and Standard Error.
- Enhanced Knowledge of Sample Surveys in Agriculture.

Suggested Readings Books:-

Text Books

- Sankhyiki (Hindi) – S.P. Singh
- Krishi Sankhyiki (Hindi) – S.R.S. Chandel
- Fundamental of Statistics – S.C. Gupta
- Statistical Methods A. Majumder, P.K. Sahu

Reference Books

- Basic Statistics – R. A. Fisher
- Elements of Agricultural Statistics – Ramesh Chandra Bharti Anil Kumar Bharti

LIVESTOCK & POULTRY MANAGEMENT

CREDITS 4 (3+1)

DEPARTMENT: ANIMAL PRODUCTION

COURSE OBJECTIVE:

1. To acquaint the students about different breeds of livestock & poultry and their feeding, breeding and management.
2. To acquaint the students about common diseases of livestock & poultry and their vaccination protocol.

Theory

- UNIT-I** 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-II** Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers.
- UNIT-III** Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.
- UNIT IV** Digestion in livestock and poultry. Classification of feeds stuffs. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.
- UNIT-V** Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

1. Formulation of concentrate mixtures. Clean milk production, milking methods.
2. Hatchery operations, incubation and hatching equipments.
3. Management of chicks, growers and layers, debeaking, and vaccination. External body parts of cattle, buffalo, sheep, goat, swine and poultry.
4. Handling and restraining of livestock. Identification methods of farm animals and poultry.

5. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.
6. Judging of cattle, buffalo and poultry. Culling of livestock and poultry.
7. Layout of housing for different types of livestock. Computation of rations for livestock.

COURSE OUTCOME

- After study of this subject the students will be able to differentiate between various breeds of livestock and poultry and will be able to manage livestock and poultry units professionally.

Suggested Readings Books:-

Text Books

- Banerjee, G.C. 1993. The Text Book of Animal Husbandry. Oxford Book Company, CALCUTTA
- ICAR, 2001. A Hand Book of Animal Husbandry.
- Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production. Vikas Publishing House Private Limited, GHAZIABAD, Uttar Pradesh.
- Hand book of Animal husbandry-Indian council of agricultural research publication, New Delhi, Third edition, 2002
- gs.McqdvkWQ ,uheyglos.M⁹h¹/₄fgUnh¹/₂vkbZ-lh-, -vkj-
- vk/kqfudi'kqmRiknu ,oaizca/ku&MkW- jkek/kkj flag&vkbZ-lh-, -vkj-
- i'kqiky&txnh'kizlkn&dY;k.khifCyds'ku
- Livestock Production and Management – Shashtri – Kalyani Publication

Reference Books

- Dairy India Year Book 2001. A-25, Priya darshini Vihar, DELHI.
- Gopala Krishnan, C.A., and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publishing House Private Limited, Ghaziabad, U.P.,
- Indian Poultry Industry Year Book 1998. A25 Priya darshini Vihar, DELHI.
- Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS., CHENNAI-7.
- Maynard, C. And Loosli, S. 1989. Animal Nutrition. Tata Mc Graw Hill Publishing Company Limited, NEW DELHI.
- Prabakaran, R., 1998. Commercial Chicken Production. Publisher P. Saranya, 5/2, Ramalingam

Street, Seven Wells,CHENNAI-1.

- Ranjan, S.K. 1985. Animal Nutrition in Tropics. Vikas Publishing House Private Limited, Ghaziabad, Uttar, Pradesh.
- Sukumar De., 1980. Outlines of Dairy Technology. Oxford University Press,DELHI.
- Dairy Farming – Avtar Singh and B.K.Joshi

SEMESTER IV / SECOND YEAR

Sr. No.	Subject Code	Subject Name	Credit
1.	ABAG 403	Crop Production Technology-II (Rabi crops)	2(1+1)
2	ABHO 403	Production Technology for Ornamental Crops, MAPs and Landscaping	2 (1+1)
3	ABAE 403	Renewable Energy and Green Technology	2(1+1)
4	ABSC 402	Problematic Soils and their Management	2(2+0)
5	ABHO 404	Production Technology for Fruit and Plantation Crops	2 (1+1)
6	ABGP 403	Principles of Seed Technology	3(1+2)
7	ABAG 404	Farming System and Sustainable Agriculture	1(1+0)
8	ABEC 403	Agricultural Marketing Trade & Prices	3(2+1)
9	ABAG 405	Introductory Agro Meteorology & Climate change	2(1+1)
10	ABEL 401	Biopesticides & Biofertilizers	2 (1+1)
Total Credit			21(12+9)

CROP PRODUCTION TECHNOLOGY-II (RABI CROPS)

CREDITS 2(1+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- Better knowledge for the cultivation of growing rabi seasoncrops.
- To identify the different weed species in rabi seasoncrops.
- To study the basis elements of crop production and their role in agriculturaleconomy.
- To study the requirement of new technology for commercial basedcultivation.

Theory

Origin, geographical distribution, economic importance, Soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops.

UNIT-1 Cereals-wheatandbarley

UNIT-II Pulses-chickpea,lentil,peas

UNIT-III Oilseeds-rapeseed, Mustard andsunflower;

UNIT-IV Sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass andcitronella,

UNIT-V Forage crops-berseem, Lucerne andoat.

Practical

1. Sowing methods of wheatandsugarcane. Identification of weeds in rabiseasoncrops. Study of morphological characteristics of rabcrops.
2. Study of yield contributing characters of rabiseasoncrops. Yield and juice quality analysis ofsugarcane.
3. Study of important agronomic experiments of rabcrops at experimental farms. 6.Studyof
4. Rabi forage experiments.
5. Oil extraction of medicinal crops, visit to research stations of relatedcrops.

COURSE OUTCOME:

- To knowledge the best cultivation use in cultivation

o enics and animals roles in agriculture. □ To able cost
f effective crops for increase economic level of India.
r □ To calculate the accurate doses of herbicides and pesticide
a application in crops. □ To knowledge about the NUE increase in rabi
b season crops.

i

c *Suggested Reading*

r **Text Books**

- o 1. Agriculture Competitive at a Glance, Satyakumari Sharma (2017) Kushal
p Publications and Distributors 1st Edition, 2017 edition.
s 2. A History of Agriculture in India - M.S. Randhawa, Vol. IV (1947-1981),
ICAR, New Delhi.
T 3. Principles of Agronomy - S.R. Reddy, Kalyani Publication, New Delhi.
o 4. *Systematic Agricultural Geography*. Husain, M. 1996. Rawat Publications, Jaipur
i 5. Textbook of Field Crops Production: Foodgrain Crops Vol. I, Rajendra
m Prasad, 2013. New Dehli.
p 6. Textbook of Field Crops Production: Foodgrain Crops Vol. II, Rajendra
o Prasad, 2013. New Dehli. **Reference**

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- Prasad, R. (Ed.). 2001. *Field Crop Production*. ICAR, New Delhi
- Modern Techniques of Raising field Crops Chhidda Singh & Prem Singh
- Das, P.C. 1997. *Oilseed Crops of India*, Kalyani Publishers., New Delhi. ICAR [Indian Council of Agricultural Research]. 2006. *Hand Book of Agriculture*. ICAR, New Delhi
- Chidda Singh, Prem Singh and Rajbir Singh. 2003. *Modern Techniques of Raising Field Crops* (2nd ed.). Oxford & IBH, New Delhi.
- Rabi Crop Production RL Arya & Keshv Arya

PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAPS AND LANDSCAPING CREDITS 2(1+1)

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVE:

- Give basic knowledge ornamental Horticulture and Landscaping.
 - Give basic knowledge ornamental material and types of garden and stage of gardening.
- To give the knowledge of ornamental Horticultural are crops identification.
- To give the basic knowledge and cultivation of medicinal crops and aromatic crops.
 - To give the knowledge based on different type classification in medicinal crops and aromatic crops.

Theory

UNIT-1 Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping.

Principles of landscaping. Landscape uses of trees, shrubs and climbers.

UNIT-2 Production technology of important cut flowers like rose, gerbera, carnation, lily and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.

UNIT-3 Package of practices for loose flowers like marigold and jasmine under open conditions.

UNIT-4 Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemon grass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

UNIT-5 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/MA Punit.

COURSE OUTCOME

- Be able to develop gardens different types of mughal, Japanese, Persian through gardening
- Be able to develop landscaping different style of formal, free, wild and informal garden through gardening
- To able to develop lawn for recreation and garden beautification feeling a natural way
- To give knowledge about the production technology of medicinal and aromatic plants.
- To give knowledge about the site selection of nursery and their management.

Suggested Readings

Text Books

- Bland, J. and Davidson, W. 2004. *Houseplant – Survival Manual*. QuantumBooks Ltd. London.
- Carpenter, P.L., Walker, T.D and Lanphear, F.O. 1975. *Plants in the Landscape*. W.H. Feeman and Co., San Francisco.
- Chadha, K.L. and Chowdhury, B, 1992. *Ornamental Horticulture in India*. ICAR New Delhi
- Desai, B.L. 1979. *Planning and Planting of Home Gardens*. Indian Council of Agricultural Research, New Delhi.
- Farooqui, A.A., Khan, M.M. and Sreeramu, B.S. 1997. *Cultivation of medicinal and aromatic Crops in India*. Naya Prakash, Kolkatta.
- Jain, S.K. 1979. *Medicinal Plants*. National Book Trust of India, New Delhi.
- Kirthikar, K.R. and Basu, B.D. 1993. *Indian Medicinal plants*, Vol. 1-4. Lalit Mohan
- Kurian, A and Sankar, M.A. 2007. *Medicinal Plants*. New India Publishing Agency, New Delhi.
- Sivarajan, V.V. and Balachandran, I. 1994. *Ayurvedic drugs and their plant sources*. Oxford & IBH Pub. Co.

Reference Books

- Chadha, K.L. and Gupta, R. 1995. *Advance in Horticulture Vol. 11 Medicinal & Aromatic plants*. Malhotra Pub. House., New Delhi.
- Bhandari, K. and Prakash, J. 1994. *Floriculture: Technology Trades, Trends*. Oxford & IBH Bose, T.K and Yadav, L.P. ed. 2003. *Commercial Flowers*. Naya Prakash, Calcutta, India Publishing Company, New Delhi
- Bose, T.K., Maiti, R. G., Dhua, R.S. and Das, P. ed. 1999. *Floriculture and landscaping*. Naya Prakash, Culcutta, India.
- Chadha, K.L. 2001. *Hand book of Horticulture*. ICAR, New Delhi.

RENEWABLE ENERGY AND GREEN TECHNOLOGY

CREDITS 2(1+1)

DEPARTMENT: AGRICULTURAL ENGINEERING

COURSE OBJECTIVE:

- To study sources and classification of energy.
- To understand applied use of different types of renewable energy sources.
- To study biogas plants and their utilization

Theory

UNIT-1 Classification of energy sources, contribution of these of sources in agricultural sector,

UNIT-2 Familiarization with biomass utilization for biofuel production and their application,

UNIT - 3 Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and bio-oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application,

UNIT - 4 Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application,

UNIT-5 Introduction of wind energy and their application.

Lecture schedule

1. Classification of energy sources,
2. Contribution of these of sources in agricultural sector,
3. Familiarization with biomass utilization for biofuel production and their application,
4. Familiarization with types of biogas plants
5. The gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as

Bio energy resource,

6. Introduction of solar energy, collection and their application,
7. Familiarization with solar energy gadgets and Solarcooker
8. Solar water heater, application of solarenergy
9. Solar drying, solar pond, solardistillation
10. Solar photovoltaic system and their application
11. Introduction of wind energy and their application

Practical

1. Familiarization with renewable energy gadgets. To study biogasplants,
2. To study gasifier, To study the productionprocess of biodiesel,
3. To study briquettingmachine,
4. Tostudytheproductionprocessofbio-fuels.Familiarizationwithdifferent solarenergy gadgets.
5. To study solar photovoltaic system: solar light, solar pumping, solarfencing.
6. To studysolarcooker,
7. To study solardryingsystem.
8. To study solar distillation and solarpond.

COURSE OUTCOMES

- Knowledge of production ofLiquidbiofuel.
- Knowledge of wind energy and their mills.
- Clear understanding of principles of agriculturalwastes.

Suggested Readings

- Rai G.D., (2010) RenewableEnergy.
- Climatic Changes & Their Remedial Measures, (2001), Rathore N.S., KurchaniaA.K., ShubhiPublications, Gurgaon, Delhi,pages228.ISBN10:818722651XISBN 13: 9788187226512
- Sustainable Development with Renewable Energy Sources, (2004), Singh Pratap, Rathore N.S.,
- Kurchania A.K., Mathur A.N., Yash Publications, Bikaner, ISBN 10: 8186882162 /ISBN 13:9788186882160
- Biomethanation Technology, (2006), Rathore N.S., Kurchania A.K., Apex Publications,

Udaipur, pages 387. ISBN 10: 813010038X /ISBN 13: 9788130100388

- Renewable Energy Theory & Practice, (2008), Rathore N.S., Panwar N.L., KurchaniaA.K., Himanshu Publications, New Delhi.ISBN9788179061282
- Renewable Energy Theory & Practice, (2006), Rathore NS, Panwar NL, KurchaniaAK, ISBN 9788179061282, Himanshu Publications, NewDelhi,
- Non Conventional Energy Sources, (2007), Rathore N.S., Panwar N.L., KurchaniaA.K., ISBN 9788179061664. Himanshu Publications, NewDelhi,
- Non Conventional Energy Sources, (2007), Rathore N.S., Panwar N.L., KurchaniaA.K Himanshu Publications, Udaipur,ISBN9788179061664
- Jatropha-Cultivation & Processing Practices, (2008), Rathore NS, Panwar N. L., KurchaniaA.K., Himanshu Publications, New Delhi . ISBN 10: 8179061965 ISBN 13:9788179061961

Reference Books:

- Solar Energy – Principles of Thermal Collection and Storage” by S PSukhatme
- Solar Engineering of Thermal Processes” by JA Duffie and WABeckman
- Biomass Regenerable Energy” by D D Hall and RPGrover

PROBLEMATIC SOILS AND THEIR MANAGEMENT

CREDITS 2 (2+0)

DEPARTMENT: SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

COURSE OBJECTIVE:

- To study about remote sensing and GIS in management of problem soil. To gain knowledge of soil.
- To study about soil quality and standards.
- To study about reclamation and management of problematic soil.

Theory

UNIT-1 Soil quality and health. Distribution of Waste land and problem soils in India, Their categorization based on properties.

UNIT-2 Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

UNIT-3 Irrigation water quality and standards, utilization of saline water in agriculture.

UNIT-4 Remote sensing and GIS in diagnosis and management of problem soils.

UNIT-5 Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification: Problematic soils under different Agro-ecosystems

COURSE OUTCOME:

- Knowledge gained about soil quality and health.
- Learnt about quality of irrigation water.
- Received knowledge about Flooded and polluted soil.

Suggested Readings

Text Books

- The Nature and Properties of Soils. 10th Edn. Printice Hall India pvt. Ltd. New Delhi
- Raymond W Miller and Roy L. Donahue. 1992. Soils and Introduction to Soils and Plant Growth. 6th edn. Printice Hall India pvt. Ltd. New Delhi
- Robert .M. Devlin and Francis H. Witham 1986. Plant Physiology. 4th Edn. CBS Publishers and Distributors New Delhi.

Reference Books

2. Fundamentals of Soil Science – ICAR Publication, NewDelhi.
3. Introductory of soil Science, Das, D.K. (2015), KalyaniPublishers.

PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS CREDITS 2(1+1)

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVES

- To give Basic knowledge about all Fruit crops.
- To give Basic knowledge Fruit crop cultivation and Fruit crop classification based on different type.
- To give the knowledge of Identification of Fruit crops.

Theory:-

UNIT-I Importance and scope of fruit and plantation crop industry in India;

UNIT-II High density planting; use of rootstocks;

UNIT III Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya,

UNIT IV Production technologies for the cultivation of apple, pear, peach and; minor fruits- pineapple, pomegranate, jackfruit, strawberry, nut crops;

UNIT V Production technologies for the cultivation of plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Lecture Schedule

1. Importance and scope of fruit crops-High density planting- Canopy management
- Use of rootstocks in fruit crops.
2. Production technologies of Mango-Botanical name-Family-Origin-Introduction-Varieties
- Climate - Soil- Propagation - Planting - Manuring- Irrigation - Inter Cultivation - Harvesting - Yield - Pests - Stem borer - Nut weevil-Fruit fly - Leaf webber - Diseases - Powdery mildew - Anthracnose - Sooty mould Mango malformation - Physiological disorders-Fruit drop- Alternate bearing- Spongy tissue.
3. Production technology of Banana-Botanical name-Family-Origin-Importance- Varieties- Climate - Soil - Propagation- Planting - Manuring - Irrigation - Inter Cultivation practices - Harvesting - Yield - Pests - Rhizome weevil - Pseudo Stem weevil- diseases - Sigatoka leaf spot - Panama wilt - Rhizome rot-Bunchy top.
4. Production technology of Citrus - Botanical name - Family - Origin- Introduction - Varieties - Climate-Soil-Propagation-Planting-Manuring-Irrigation-Inter Cultivation-Harvesting-Yield- Yield - Pests - Butterfly - Fruit sucking moth - Citrus leaf miner - Diseases - Gummosis - Canker -

Tristeza - Physiological disorders - Fruit drop – Granulation.

5. Production technology of Grape- Botanical name- Family- Origin- Introduction - Varieties – Climate – Soil - Propagation- Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests-Flea beetles – Mealy bug - Stem girdler Diseases- Powdery mildew - Downy Mildew – Anthracnose - Physiological disorders- Pinkberries.
6. Production technology of Guava and Litchi - Botanical name- Family- Origin- Introduction - Varieties – Climate – Soil- Propagation - Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests of Guava - Tea mosquito bug - Mealybug - Diseases of Guava – Wilt. Production technology of Papaya - Botanical name - Family- Origin- Introduction- Varieties – Climate – Soil – Propagation – Planting – Manuring - Irrigation – Inter Cultivation – Harvesting – Yield–Pests-Nematodes-diseases-Powdery mildewFootrot–Mosaic.
7. Production technology of Apple, Pear, Peach - Botanical name – Family – Origin – Importance – Varieties – Climate – Soil – Propagation - Planting- Manuring- Irrigation – Inter Cultivation – Harvesting – Yield – Pests of Apple - Wooly aphid, Codling moth - Pests of Peach - Fruit Fly - Diseases of Apple- Scab - Powdery mildew- Physiological disorder in apple - Bitterpit - Diseases of Pear- Fruit spot - Diseases of Peach- Leafcurl.
8. Production technology of Minor fruits- Pineapple, Pomegranate - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield - Pests of pineapple- Mealy bug -Pests of pomegranate- Butterfly - Fruit sucking moth - Diseases of pineapple - Leaf and fruit rot - Diseases of pomegranate – Anthracnose and bacterial leaf spot- Physiological disorders of pomegranate- Fruitcracking.
9. Production technology of Jackfruit, Strawberry, Nut crops (Almond &Walnut) - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation-Planting-Manuring- Irrigation–Intercultivation–Harvesting–Yield
Pests of Jackfruit - Spittle bug - Fruit borer – Diseases of Jackfruit - Rhizopus rot

Die back.

Plantation crops- Scope and Importance - Coconut – Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield – Processing – Pests of Coconut Black headed caterpillar - Rhinoceros beetle - Red palm weevil diseases of Coconut – Ganoderma - Tatipaka - Drey blight.

10. Production technology of Arecanut - Botanical name- Family- Origin- Importance- Varieties – Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – harvesting – Yield – Processing - Pests of Arecanut - Mite - Spindle bug Diseases of Arecanut - Mahali (Fruit rot)-Footrot.
11. Production technologyof Cashew - Botanical name- Family- Origin- Importance- Varieties– Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield – Processing - Pests of Cashewnut - Stem borer - Tea mosquito bug - Diseases of Cashewnut - Die back or Pinkdisease–Anthracnose.
12. Production technology of Tea - Botanical name- Family- Origin- Importance- Varieties– Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield - Processing- Pests of Tea - Tea mosquito bug- Red spider mite - Diseases of Tea - Algal leaf spot- Blisterblight.

Production technology of Coffee - Botanical name- Family- Origin- Importance- Varieties– Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield - Processing- Pests of Coffee -White borer - Red borer and Green scales – Diseases of Coffee - Rust- Die back -Berry blotch.

13. Production technology of Rubber - Botanical name- Family- Origin- Importance- Varieties- Climate – Soil- Propagation- Planting- Manuring- Irrigation – Inter cultivation – Harvesting – Yield - Processing- Pests of Rubber - Scale insect - Mealy bug and mite - Diseases of Rubber - Birds eye spot – Pinkdisease.

Practical:-

1. Seed propagation. Scarification and stratification of seeds.
2. Propagation methods for fruit and plantation crops including Micro-propagation.
3. Description and identification of fruit.
4. Preparation of plant bio regulators and their uses, Pests, diseases.
5. Physiological disorders of above fruit and plantation crops,
6. Visit to commercial orchard.

COURSE OUTCOME

- Be able to higher production using high yielding variety through high innovative practices
- Be able to handling and utilization of tropical and subtropical fruits through preservation and drying.
- Be able to develop new variety and new species through propagation methods, selection and hybridation.

Suggested Readings Books:-

Text Books

- Chadha, K.L, Reddy, B.M.C and Sikhamony, S.D. 1998. Pineapple. ICAR, New Delhi.
- Collins, J.L. 1968. The Pineapple. Leonard Hill, London.
- Davies, F.S and Albrigo, L.G. 1994. Citrus. CAB International, UK.
- Galletta, G.J. and Himelrick, D.G. 1989. Small Fruit Crop Management. Prentice Hall, New Jersey.
- Kumar, N. 1997 (6th Edition). Introduction to Horticulture. Rajhalakshmi Publications, Nagercoil.

Reference Books

- Basic Horticulture, Jitendra Singh, Kalyani Publication.
- Hayes, W.B. 1957. Fruit Growing in India. Kitabitan, Allahabad.
- Amar Singh, 1986. Fruit Physiology and Production. Kalyani Publishers, New Delhi.
- Bose, T.K, Mitra, S.K. and Sanyal, D. 2002. Fruits: Tropical and Subtropical. Vol. I
& Nayaprakash publications, Calcutta.
- Instant Horticulture S. N. Gupta

PRINCIPLES OF SEED TECHNOLOGY CREDITS 3 (1+2)

DEPARTMENT: PLANT BREEDING AND GENETICS

COURSE OBJECTIVE:

- To study seed and its types, quality and storage.
- To impart knowledge on production of nucleus & breeder's seed, Foundation and certified seed production.
- To study seed marketing and its related organizations.

Theory

UNIT – 1 Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed.

UNIT – 2 Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection.

UNIT - 3 Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

UNIT - 4 Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.

UNIT - 5 Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Lecture Schedule

1. Introduction to seed production, importance of seed production.
2. Deterioration of crop varieties, factors affecting deterioration and their control.
3. Seed quality; definition, characters of good quality seed, different classes of seed, maintenance of genetic purity during seed production,
4. Production of nucleus & breeder's seed, foundation and certified seed
5. Seed Production in maize (varieties, hybrids); Foundation and certified seed production of rice (varieties & hybrids)
6. Foundation and certified seed production of tomato, brinjal, chilli and bhindi
7. Seed certification, procedure for seed certification, field inspection and field counts
8. Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories
9. Duties and powers of seed inspectors, offences and penalties
10. Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation.
11. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights
12. Seed Drying: forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air.
13. Heated air drying, types of air distribution systems for seed drying
14. Seed processing: air screen machine and its working principle, different upgrading equipments and their use.
15. Establishing a seed testing laboratory and seed testing procedures for quality assessment
16. Seed treatment, importance of seed treatment, types of seed treatment, equipments used for seed treatment
17. Seed packing and seed storage, general principles of seed storage, factors affecting seed longevity during storage and conditions required for good storage, measures for pest and disease control, temperature control
18. Seed marketing, marketing structure, marketing organizations, factors affecting seed marketing.

Practical

- Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi.
- Seed production in major pulses: Urd, Mung, Pigeon pea, Lentil, Gram, Field bean, pea.
- Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard.

- Seed production in important vegetable crops.
- Seed sampling and testing: Physical purity, germination, viability etc.
- Seed and seedling vigor 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.

COURSE OUTCOME:

- Knowledge on Seed Production and Seed quality.
- Production of nucleus & breeder's seed, Foundation and certified seed production.
- Familiarize with Seed Act and Seed Act enforcement.
- Informed about Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights.
- General principles of seed storage.
- Understand Seed marketing structure and marketing organization.

Suggested Readings

Text Books

- Agrawal, P.K. 1994. Principles of Seed Technology Kalyani Publishers, Ludhiana
- Agrawal, R.L. 1990. Seed Technology Kalyani Publishers, Ludhiana
- Neal C. Stoskopf, Dwight T. Tomes and B.R. Christie. 2006. Plant Breeding Theory and Practice. Scientific Publishers (India), Jodhpur.
- Mishra DK, Khare D, Bhale M.S & Koutu GK. 2011. A Handbook of Seed certification, Agribios (India) publisher, Jodhpur.
- Khare D & Bhale M.S 2016. Seed Technology, Scientific Publishers.

Reference Books

- Agrawal, P.K. and N. Dadlani 1995. Techniques in Seed Science and Technology
- Dahiya, B.S.; Rai, K.N. 1995 Seed Technology Kalyani Publishers, Ludhiana Nema, N.P. 1999 Principles of Seed Certification and Testing Allied Publishers Pvt. Ltd., New Delhi.

FARMING SYSTEM AND SUSTAINABLE AGRICULTURE

CREDITS 1(1+0)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVES

- To study the cropping and farming system.
- To understand the components of integrated farming.
- To understand the FYM, vermicompost and coir pith etc.
- To study the green manures and sustainable agriculture.
- To study integrated Nutrient management and Soil quality.

Theory:-

UNIT- I Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance,.

UNIT- II 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- III Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability.

UNIT- IV Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones.

UNIT- V Resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

COURSE OUTCOME

- An ability to know the techniques for agriculture sustainability.
- To know the problem Soil, acid, Salt affected and calcareous Soil characteristics, and Nutrient availabilities.
- To understand the different types of method of reclamation of mechanical, chemical and biological method.
- To know the soil fertilizer application & recoup.

Suggested Readings Books:-

Text Books

- Balasuramaniyan, P. and Palaniappan, SP. 2003. *Principles and Practices of Agronomy*. Agrobios(India)
- Barnes, A.C. 1964. *The Sugarcane*. Interscience Publishers, New Delhi
- Chidda Singh, Prem Singh and Rajbir Singh. 2003. *Modern Techniques of Raising Field Crops* (2nd Ed.). Oxford & IBH, New Delhi.
- Lekshmikantan, M. 1983. *Technology in Sugarcane Growing*. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi
- Purselove, J.W. 1974. *Tropical Crops: Dicotyledons*. The English Language Book Society and Longman, London.

Reference Books

- Cropping and farming system S.C.Panda
- farming system and sustainable Agriculture S.R.Reddy

AGRICULTURAL MARKETING TRADE & PRICES

CREDIT 3(2+1)

DEPARTMENT: AGRICULTURAL ECONOMICS

COURSE OBJECTIVE:

- To study competitive strategies of marketing.
- To investigate pricing and promotion strategies.
- To learn present status and prospects of international trade

Theory

UNIT – I 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 agricultural commodities nature and determinants of demand and supply of farm products, producer's surplus—meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agricultural commodities.

UNIT – II 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: Marketing process—concentration, dispersion and equalization; exchange functions—buying and selling; physical functions—storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark).

UNIT - III Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs.

UNIT - IV Price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions-CWC, SWC, FCI, CACP & DMI—their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of future trading.

UNIT - V 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 agricultural commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

1. Plotting and study of demand and supply curves and calculation of elasticities.
2. Study of relationship between market arrivals and prices of some selected commodities.
3. Computation of marketable and marketed surplus of important commodities.
4. Study of price behavior over time for some selected commodities.
5. Construction of index numbers.
6. Visit to a local market to study various marketing functions performed by different agencies.
7. Identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class.
8. Visit to market institutions—NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning.
9. Application of principles of comparative advantage of international trade.

Lecture Schedule:

- 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 agricultural commodities:
- Nature and determinants of demand and supply of farm products

- Producer's surplus—meaning and its types, marketable and marketed surplus
- Factors affecting marketable surplus of agri-commodities 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 on side ratios 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:
- Marketing process-concentration, dispersion and equalization;
- Exchange functions— buying and selling;
- Physical functions— storage, transport and processing;
- Facilitating functions— packaging, branding, grading, quality control and labeling (AGMARK)
- Market functionaries and marketing channels
- Types and importance of agencies involved in agricultural marketing; meaning and definition; number of channel levels;
- Integration, efficiency, costs and prices 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; marketing costs;
- Role of Govt. in agricultural marketing:
- Public sector institutions - CWC, SWC, FCI, CACP & DMI—their objectives and functions
- Cooperative marketing in India
- Risk in marketing: Types of risk in marketing
- Speculation & hedging; an overview of future trading
- Agricultural prices and policy: Meaning and functions of price

COURSE OUTCOME

- Understanding of uncertainty and risk in marketing.
- Knowledge of agricultural marketing, cooperative marketing.

Suggested Readings

Text Books

1. Acharya, S.S. and Agarwal, N.L., 2004, Agricultural Marketing in India, Oxford and IBH Publishing Co. NewDelhi.
2. G.L. Meena, S.S. Burark, D.C. Pant and Rajesh Sharma, 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN:978-81-8321-418-First edition.
4. Kahlon, A.S. and George, M.V., 1985, Agricultural Marketing and Price Policy, Allied Publication Pvt. Ltd., NewDelhi.
5. Mamoria, C.B and Joshi, R.L., 1971, Principles and Practice of Marketing in India, Kitabmahal, Allahabad.

Reference Books

1. K Nirmal Ravi Kumar, Objective Agricultural Economics. Astral Publicaiton.
2. Kohls, Richard L. and Uhl, Joseph N., 1980, Marketing of Agricultural Products, Macmillan Publishing Co., Inc. New York F A B E
3. Acharya, S.S. and Agarwal, N.L., 1994, Agricultural Price Analysis and Price Policy, Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi.
4. Acharya S.S Agrawal N.L, 2019. Agricultural marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi

INTRODUCTORY AGRO METEOROLOGY & CLIMATE CHANGE

CREDITS 2 (1+1)

DEPARTMENT: AGRONOMY:

COURSE OBJECTIVE:

- To learn agro-meteorology and climate change.
- To study nature and its properties.
- To study about weather forecasting.

Theory

UNIT - I 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 - II Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth;

UNIT - III 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 - IV 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 - V 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

1. Visit of Agro meteorological Observatory, site selection of observatory, exposure of instruments and weather data recording.
2. Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law.
3. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS.
4. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.
5. Measurement of soil temperature and computation of soil heat flux.
6. Determination of vapor pressure and relative humidity.
7. Determination of dew point temperature.
8. Measurement of atmospheric pressure and analysis of atmospheric conditions.
9. Measurement of wind speed and wind direction, preparation of wind rose.
10. Measurement, tabulation and analysis of rain.
11. Measurement of open pan evaporation and evapotranspiration.
12. Computation of PET and AET.

COURSE OUTCOME:

- Understanding of bad effects of climatic change.
- Knowledge of weather forecasting.
- Knowledge about determination of vapor pressure and relative humidity.
- Knowledge of measurement, tabulation and analysis of rain.

Suggested Readings Books

Text Books

- Principles of Agronomy - S.R. Reddy (1999), Kalyani Publication, New Delhi
- Hand Book of Agriculture (2006) – ICAR Publication
- Introduction to Agronomy and soil and water Management - V.G. Vaidya and K.K. Sahatrabudhe
- Agricultural Meteorology - GSLHV Prasad Rao

- Principles and Practices Agronomy-Balsubramaniyan, P and Palaniappan, S.P. 2001–Agribios
- APracticalGuideonAgrometeorology- K.K.Agrawal andA.P.Upadhyay

Reference Books

- Introductory Agrometeorology and climate change SR- Reddy – KalyaniPublication
- Agriculture Meteorology P. S. Tiwari Shree Krishna PublishersAgra
- Climatology - Lal, D.S. (1997), Sharda Pustak Bhawan Publication,Allahabad

BIOPESTICIDES & BIOFERTILIZERS

CREDIT 3(2+1)

DEPARTMENT: ELECTIVE COURSE

COURSE OBJECTIVE

- To study types, uses & production of Biopesticides.
- To study about types, application & Production of Biofertilizers

Theory

UNIT – I History and concept of biopesticides. Importance, scope and potential of bio pesticide. Definitions, concepts and classification of bio pesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses.

UNIT-II Mass production technology of bio-pesticides. Virulence, pathogen city and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

UNIT-III Bio fertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers-*Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal bio fertilizers- AM mycorrhiza and ectomycorrhiza.

UNIT-IV Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.

UNIT-V 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.

Lecture Schedule:

1. History and concept of biopesticides
2. Importance, scope and potential of biopesticide

3. Definitions, concepts and classification of bio pesticides viz. pathogen, botanical pesticides, and biorationales.
4. Botanicals and their uses.
5. Mass production technology of bio-pesticides
6. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes
7. Methods of application of biopesticides
8. Methods of quality control and Techniques of biopesticides.
9. Impediments and limitation in production and use of biopesticide.
10. Bio fertilizers - Introduction, status and scope.
11. Structure and characteristic features of bacterial biofertilizers-*Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*
12. Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*
13. Haplosporidium and fungal bio fertilizers- AM mycorrhiza and ectomycorrhiza.
14. Nitrogen fixation - Free living and symbiotic nitrogen fixation
15. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization
16. Production technology: Strain selection, sterilization, growth and fermentation
17. Mass production of carrier based and liquid biofertilizers.
18. FCO specifications and quality control of biofertilizers
19. Application technology for seeds, seed-lings, tubers, setts etc.
20. Application technology for seeds, seed-lings, tubers, setts etc.
21. Bio fertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers

Practical

1. Isolation and purification of important bio pesticides: *Trichoderma*, *Pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production.
2. Identification of important botanicals.
3. Visit to bio pesticide laboratory in nearby area.
4. Field visit to explore naturally infected cadavers
5. Identification of entomopathogenic entities in field condition.
6. Quality control of biopesticides.
7. Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria.
8. Mass multiplication and inoculum production of biofertilizers.
9. Isolation of AM fungi - Wet sieving method and sucrose gradient method.
10. Mass production of AM inoculants.

References

- Biological Control of Insect, Pests- Ignacimuthus S.S. and Jayaraj-Phoenix Publication, New Delhi
- Biological Control- Van Driesche and Bellows T.S.Jr.- Chapman & Hall, New York
- Botanical Pesticides in Agriculture- Prakash A and Rao J. - Lewis Publication, New York
- Biological Control of Insect, Pests and Weeds- De Bach P- Chapman & Hall, New York
- Theory and Practices of Biological- Huffaker C.B. and P.S. Messenger Academic Press, London

SEMESTER V / THIRD YEAR

Sr. No.	Subject Code	Subject Name	Credits
1	ABPP-502	Principles of Integrated Pest and Disease Management	3(2+1)
2	ABSC 503	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3	ABEN 502	Pests of Crops and Stored Grain and their Management	3(2+1)
4	ABPP-503	Diseases of Field and Horticultural Crops and their Management -I	3 (2+1)
5	ABGP 504	Crop Improvement-I (<i>Kharif Crops</i>)	2 (1+1)
6	ABEX 504	Entrepreneurship Development and Business Communication	2 (1+1)
7	ABAG 506	Geoinformatics and Nano- Technology and Precision Farming	2 (1+1)
8	ABIP 501	Intellectual Property Rights	1(1+0)
9	ABEL-502	Applied Hi-tech Horticulture	3 (2+1)
10	ABAG 507	Practical Crop Production – I (<i>Kharif crops</i>)	2 (0+2)
Total Credit			24 (14+10)

PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT

3(2+1)

COURSE CODE : ABPP-502

COURSE OBJECTIVE:

- To study principles and tools of IPM.
- To learn the economic importance of insect pests.
- To get acquainted the safety issues in pesticide uses.

Theory:

UNIT – I Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM.

UNIT - II Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level.

UNIT - III Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management.

UNIT - IV Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease).

UNIT – V 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 bio-control 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 farmers fields.

Lecture Schedule: Theory (IPM & IDM)

S.N	Topic	No. of lectures
1	Categories of insect pests , IPM: Introduction, history, importance, concepts, principles and tools	01
2	Economic importance of insect pests and pest risk analysis.	01
3	Methods of detection and diagnosis of insect pest	01
4	Calculation and dynamics of economic injury level(EIL) and importance of Economic thresholdlevel(ETL)	01
5	Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment	03
6	Introduction to conventional pesticides for the insect pests	01
7	Survey surveillance and forecasting of Insect pest	01
8	Development and validation of IPM module	02
9	Implementation and impact of IPM (IPM module for Insect pest)	02
10	Safety issues in pesticide uses.	01
11	Political, social and legal implication of IPM	01
12	Case histories of important IPM programmes	01
13	Categories of diseases , IDM: Introduction, history, importance, concepts, principles and tools	01
14	Economic importance of diseases and pest risk analysis.	01
15	Methods of detection and diagnosis of diseases	01
16	Calculation and dynamics of economic injury level(EIL) and importance of Economic thresholdlevel(ETL)	01
17	Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment	03
18	Introduction to conventional pesticides for the diseases	01
19	Survey surveillance and forecasting of diseases	01
20	Development and validation of IDM module	02
21	Implementation and impact of IDM (IDM module for Diseases)	02
22	Safety issues in pesticide uses.	01
23	Political, social and legal implication of IDM	01
24	Case histories of important IDM programmes	01
	Total	32

Lecture Schedule: Practical (IPM & IDM)

S.N	Topic	No. of lectures
1	Methods of diagnosis ,detection& Measurement of various insect pests	01
2	Assessment of crop yield losses, calculations based on economics of IPM.	01
3	Identification of bio-control agents, different predators and natural enemies.	01
4	Mass multiplication of <i>Trichoderma</i> , <i>Pseudomonas</i> , <i>Trichogramma</i> , NPV etc	01
5	Identification and nature of damage of important insect pests & their management.	01
6	Crop (agro-ecosystem) dynamics of a selected insect pest.	01
7	Plan & assess preventive strategies (IPM module) and decision making	01
8	Crop monitoring attacked by insect pest.	01
9	Methods of diagnosis ,detection& Measurement of various insect pests	01
10	Assessment of crop yield losses, calculations based on economics of IPM	01
11	Identification & Mass multiplication of bio-control agents like <i>Trichoderma</i> , <i>Pseudomonas</i> & <i>Bacillus</i> used to control diseases	01
12	Identification and nature of damage of important diseases & their management.	01
13	Crop (agro-ecosystem) dynamics of selected diseases.	01
14	Plan & assess preventive strategies (IDM module) and decision making	01
15	Crop monitoring attacked by diseases	01
16	Awareness campaign at farmer fields.	01
	Total	16

COURSE OUTCOME:

- Gain knowledge of agro-ecosystem dynamics of insectpests&Diseases.
- Integrated management of insect pests &diseases.
- Identification of bio-control agents, different predators and naturalenemies.

Text Books

1. Dhaliwal, G. S. and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers Ludhiana.
2. Metcalf, R. L. and Luckman, W. H. 1982. Introduction to insect pest management. Wiley inter science publishing, New York.
3. Larry P Pedigo 1991. Entomology and pest management, Prentice Hall of India Private Ltd., New Delhi.
4. Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu, V.G and Savithri, P. 2004. Integrated Insect Pest Management. Agrobios (India) Limited, Jodhpur.
5. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136.
6. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
7. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publ. Co. P. Ltd., New Delhi.
8. Vidyasekharan, P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi.
9. Y. L. Nene and P.N. Thapliyal, 1993. Fungicides in Plant Disease Control. Oxford and IBH Publishing Co.

Reference Books

1. Pests and disease management in organic ecosystem by Dr. S. Mohan and Dr. M.S. Gill
2. Disease of field crops and their management by Manoj Kumar Kalita
3. Plant Protection – I
Pests, Disease and Weeds - By Ruth M. Kerriush and Phillip W. Unger
4. Hand Book of Entomology by T. V. Prasad

MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT CREDITS 3(2+1)

DEPARTMENT: SOIL SCIENCE & AGRICULTURAL CHEMISTRY

COURSE OBJECTIVES

- To study fertilizer control order.
- To study fertilizers classifications and manufacturing.
- To understand the complex fertilizers secondary and micronutrient fertilizers
- To study about organic manures.
- To study soil fertility and plant nutrition.
- To study mechanism of nutrient transport to plants.

Theory:-

UNIT - I Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Integrated nutrient management.

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

UNIT - III History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.

UNIT - IV Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants.

UNIT - V Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical:-

1. Introduction of analytical instruments and their principles, calibration and applications, Colorimetric and flame photometry.
2. Estimation of available N in soils.
3. Estimation of available P in soils.
4. Estimation of available K.
5. Estimation of available S in soils.

6. Estimation of available Ca and Mg in soils.
7. Estimation of available Zn in soils.
8. Estimation of N in plants. Estimation of P in plants.
9. Estimation of K in plants.
10. Estimation of S in plants.

COURSE OUTCOME

- Gained knowledge about fertilizers classifications and manufacturing.
- Understand the complex fertilizers, secondary and micronutrient fertilizers.
- Gained knowledge about mechanism of nutrient & transport to plant.
- Learnt preparation methods of organic manures.

Suggested Readings Books:-

Text Books

- Sreeramalu, U.S. (1979). *Chemistry of Insecticides and Fungicides*. Oxford & IBH publishing Co., New Delhi.
- Tandon, H.L.S. 1992. *Fertilisers, Organic Manures, Recycleable Wastes and Biofertilisers*. FDCO, New Delhi
- Yawalkar, K.S., Agarwal, J.P. and Bokdi, S. 1984. *Manures and Fertilisers*. Agril. Horti. Publishing House, Nagpur.

Reference Books

- Singh, S.S, 1999. *Soil Fertility and Nutrient Management*. Kalyani Publishers, Delhi
- Shilpa, S, Varma, H.N and Bhargava, S.K. 2006. *Air Pollution and its Impacts on Plant growth* Published by New India Publishing Agency, New Delhi
- Ulysses, R. and Johnes, S. 1987. *Fertilisers and Soil Fertility*. Prentice Hall of India Pvt. Ltd., New Delhi

PESTS OF CROPS AND STORED GRAIN AND THEIR MANAGEMENT CREDITS 3(2+1)

DEPARTMENT: ENTOMOLOGY

COURSE OBJECTIVES

Identification of insect pest, symptoms of damage and their management.

- Studies in insect collection and preservation.
- Studies on nature of damage, systemic position, distribution, life cycle and management of cereal crop management.
- Studies in nature of damage, distribution, systemic position, life cycle and management of Horticultural crops.

Theory:-

UNIT-I 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.

UNIT - II Management of major pests and 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, narcotics, spices and condiments.

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

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

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

Practical:-

1. Identification of different types of damage.
2. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments.
3. Identification of insect pests and Mites associated with stored grain.
4. Determination of insect infestation by different methods.
5. Assessment of losses due to insects.

6. Calculations on the doses of insecticides application technique.
7. Fumigation of grain store/godown.
8. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns.
9. Determination of moisture content of grain.
10. Methods of grain sampling under storage condition.
11. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi.
12. Visit to nearest FCI godowns.

COURSE OUTCOME

- Distribution and biology of agricultural insect pest.
- Knowledge of stored grain pests.

Suggested Readings Book:-

Text Books

- Applied Entomology By Dr. Mathur and Uppadhyay
- Applied Entomology By Dr. Mathur and Uppadhyay
- Fundamentals of Agriculture Vol II by Arun Katiyan
- Insecta By Ragvendra, N. Ranayammurti
- A text book of IPM Integrated pest management by G.S. Dhaliwal & Arora

Reference Books

2. Applied Entomology K.P. Shrivastava
3. General Entomology Dr. Mathur and Uppadhyay
4. Hand Book of Entomology T. V. Prasad
5. South east Asian crop pest and their Management A.S. Atwal and G.S. Dhaliwal
6. Applied Entomology D.S. Reddy

DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT-I

3(2+1) COURSE CODE: ABPP-503

Course Objective

1. To obtain knowledge of major diseases of field crops.
2. To study disease of horticulture crops and their management

Theory:

Symptoms, etiology, disease cycle and management of major diseases of following crops

(A) Field crops

UNIT-1 Rice: blast, brownspot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghm: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Groundnut: early and late leaf spots, wilt.

UNIT-2 Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

(B) Horticulture crops

UNIT-3 Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;

UNIT-4 Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight

UNIT-5 Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Course Outcome

- Knowledge of field crops diseases of Rice, Maize, Sorghum, Bajra, and Groundnut.
- Knowledge of horticulture crops disease of Guava, Banana, and Papaya.
- Knowledge of Cruciferous vegetables crops disease.

Suggested Reading:

Text Books

1. Gupta V K and Paul, Y S 2008. IInded. Diseases of field crops. Kalyani Publishing Co. ND.
2. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata McGraw-Hill Publishing Co Ltd. ND.
3. Rangaswamy, G and Mahadevan, A. 2012. 4th ed. Diseases of crop plants in India. Prentice hall of India Pvt. Ltd, New Delhi.
4. Singh R S .2007. 8th ed. Plant Diseases. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
5. Gupta, V. K. 2014. Diseases of Fruit Crops. Kalyani Publishers
6. Chaube H.S. Crop Diseases and Their Management. PHI
7. Singh, R.P. 2013. Plant Pathology. Kalyani Publishers
8. Tripathi, D.P. 2009. Crop Diseases, Kalyani Publishers
9. Gangawane, L.V. and Khilare, V.C. 2008. Crop diseases identification and management. Daya publishing house, New Delhi.
10. Gupta, S.K. and Thind, T.S. 2006. Disease problems in vegetable production. Scientific Publishers, Jodhpur.
11. Singh, R.S. 2006. Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
12. Singh, R.S. 1994 Diseases of vegetable crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
13. Disease of field crop and horticulture crop and their management.

References:

1. Cook, A. A. 1981. Diseases of tropical and sub-tropical field fiber and oil plants. Mac Millan Publishing Co. New York.
2. Mishra A, Bohra A and Mishra, A. 2005. Plant Pathology. Agrobios. Jodhpur (India).
3. Singh R S .2007. Plant Diseases. (9th Ed.) Oxford and IBH Publishing Co. Pvt. Ltd. ND
4. Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd, . New Delhi.

CROP IMPROVEMENT-I (KHARIF CROPS) CREDITS 2(1+1)

DEPARTMENT: GENETICS & PLANT BREEDING

COURSE OBJECTIVE:

- To study techniques of *Kharif Crop* improvement.
- To learn hybrid seed production technology.

Theory

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

UNIT - II Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetative propagated crops;

UNIT - III Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability,

UNIT - IV Abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc.

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

Practical

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

- hybrid seeds production in *Kharif* crops;
5. Estimation of heterosis, inbreeding depression and heritability;
 6. Layout of field experiments.
 7. Study of quality characters, donor parents for different characters;
 8. Visit to seed production plots;
 9. Visit to AICRP plots of different field crops.
13. Crop improvement aspects in tomato mentioned in the syllabus such as Centers of origin, of species Floral biology breeding objectives and procedures etc.
 14. Modern innovative approaches for development of hybrids and varieties for yield, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
 15. Seed production technology in self pollinated, cross pollinated and vegetatively propagated Ideotype concept
 16. Climate resilient crop varieties for future.

COURSE OUTCOME:

- Knowledge of crop improvement aspects in *Kharif Crops*.
- Learnings of climate resilient crop varieties considering global warming.

Text Books

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, A. K., P.K. Ganguli and S.P. Banerjee. 1991. *Advances in Plant Breeding*. Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenty-First Century* (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. *Breeding of Field Crops*. AVI Publishing Co. INC, East Port, Connecticut, USA.

Reference Books

1. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics*. Kalyani Publishers, New Delhi.
2. Sharma, A.K. 2005. *Breeding Technology of Crop Plants* (Edt.). Yash Publishing House, Bikaner.
3. Ram. H.H. 2005. *Vegetable Breeding — Principles and Practices*. Kalyani Publishers, New

Delhi.

4. Shekhawat, S. S. (ed) (2016). *Advances and Current Issues in Agriculture*, Vol. III. Shiksha Prakashan, S. M. S.Highway,Jaipur.

**ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS
COMMUNICATION CREDITS 2(1+1)**

DEPARTMENT: AGRICULTURAL EXTENSION

COURSE OBJECTIVE:

1. To inculcate the skills of proper and effective communication in students.
2. To develop an effective and magnetic personality essential for facing competition after studies and in life.

Theory

UNIT-I Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation.

UNIT – II Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agri-enterprises, Entrepreneurial Development Process;

UNIT – III Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation),

UNIT - IV Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management,

UNIT-V Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri- entrepreneurship and rural enterprise.

Practical

1. Assessing entrepreneurial traits, problem solving skills,
2. Managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision,

3. Identification and selection of business idea, preparation of business plan and proposal writing,
4. Visit to entrepreneurship development institute and entrepreneurs.

Lecture Schedule:

1. Concept of Entrepreneur, Entrepreneurship Development
2. Concept and Meaning
3. Characteristics of entrepreneurs
4. SWOT Analysis & achievement motivation
5. Government policy and programs and institutions for entrepreneurship development
6. Impact of economic reforms on Agribusiness/Agri-enterprises
7. Entrepreneurial Development Process; Business Leadership Skills
8. Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)
9. Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills)
10. Problem solving skill, Supply chain management and Total Quality Management
11. Project Planning Formulation and report preparation
12. Financing of enterprise, Opportunities for agri-entrepreneurship and Rural enterprises.

COURSE OUTCOME:

- After completing this course the students will develop excellent verbal and non-verbal communication skills, and will be having an effective personality full of confidence to face the challenges of life

Suggested Readings:

Text Books

1. Chole, R.R., Kapse, P.S. and Deshmukh, P.R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
2. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut.
3. Karthikeyan, C. et al. 2008.. A Text Book of Agricultural Extension Management. Atlantic Publishers, New Delhi.
4. Natrajan, K. and Ganeshan, K.P. 2012. Principles of Management. Himalaya Publishing House, New Delhi.

5. Balasubramanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.
6. Dipak De & Basavaprabhu Jirli. Entrepreneurship : Theory and practice in agriculture. ISBN 81-85694-57-5, Ganga Kaveri Publishing House, D.35/77, Jangamawadimath, Varanasi- 221001 (India), Ph.-0542-2451936
7. Mukesh Pandey & Deepali Tewari. 2010. The Agribusiness Book. IBDC Publishers.
8. Nandan H. 2011. Fundamentals of Entrepreneurship. PHI Learning Pvt Ltd India.
9. Poornima Charantimath. 2006. Entrepreneurship Development: Small Business Enterprise. Pearson Education.
10. Joseph, L. Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
11. Khanka S S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
12. Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.
13. A simple approach to communication skills-Dr. Neha Mathur and V. K. Mathur – (ISBN 13: 978-93-847524-1-5) Mausam Books, J.K. Jain Brothers, Bhopal 462001
14. How to communicate effectively-Ashish Singh ISBN – 978-1-4828-1919-9 (Partridge India)

Reference Books

1. Harold Koontz & Heinz Weihrich. 2004. Essentials of Management: An International Perspective, 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192), Artech House, Inc., USA.
3. Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.
4. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall Inc., New Jersey
5. Thomas W Zimmer and Norman M Scarborough. 1996. Entrepreneurship. Prentice-Hall, New Jersey.
6. The Dynamics of personality development J.R. Bhatti

GEOINFORMATICS AND NANO-TECHNOLOGY AND PRECISION FARMING CREDIT 2(1+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- Better study for the cultivation of precision agriculture.
- To identify the remote sensing concepts and application in agriculture.
- To study the basic elements of crop production and their role in agricultural economy.
- To study the nano-technology definition, concepts and techniques.

Theory

UNIT - I Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo - informatics - definition, concepts, tool and techniques; their use in Precision Agriculture.

UNIT - II Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Geodesy and its basic principles.

UNIT-III Remote sensing concepts and application in agriculture; Image processing and interpretation.

UNIT - IV Global positioning system (GPS), components and its functions: System Simulation - Concepts and principles, Introduction to crop simulation models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.

UNIT - V Nano technology definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles nano - pesticides, nano-fertilizers, nano - sensors, use of nano technology in tillage, seed, water. Fertilizer, plant protection for scaling - up farm productivity

Practical

1. Introduction to GIS 50 software, spatial data creation
2. Editing introduction to image processing software, visual and digital interpretation of remote sensing images.
3. Generation of spectral profiles of different objects supervised and unsupervised classification and acreage estimation.
4. Multispectral remote sensing for soil mapping creation of thematic layers of soil fertility based on GIS.
5. creation of productivity and management zones fertilizers recommendations based on | vrt and STCR techniques crop stress (biotic / abiotic) monitoring using geospatial technology,
6. Use of GPS for agricultural survey.
7. Formulation, characterization and applications of nano particles in agriculture projects formulation and execution related to precision farming.

COURSE OBJECTIVES

- Better knowledge for the cultivation of precision agriculture.
- To identify the remote sensing concepts and application in agriculture.
- To knowledge the basic elements of crop production and their role in agricultural economy.
- To knowledge the nano-technology techniques.

Suggested Readings

Text Books

1. A History of Agriculture in India - M.S. Randhawa, Vol. IV (1947-1981), ICAR, New Delhi.
2. *Systematic Agricultural Geography*. Husain, M. 1996. Rawat Publications, Jaipur
3. Textbook of Field Crops Production: Foodgrain Crops Vol. I, Rajendra Prasad, 2013. New Delhi.
4. Textbook of Field Crops Production: Foodgrain Crops Vol. II, Rajendra Prasad, 2013. New Delhi.

Reference Books

- Agriculture Competitive at a Glance, Satyakumari Sharma (2017) Kushal Publications and Distributors 1st Edition, 2017 edition.
- Principles of Agronomy - S.R. Reddy, Kalyani Publication, New Delhi.

INTELLECTUAL PROPERTY RIGHTS CREDITS 1(1+0)

DEPARTMENT: PLANT BREEDING AND GENETICS

COURSE OBJECTIVE:

- To study Intellectual Property Rights.
- To impart knowledge on trade and involving related organizations.
- To impart knowledge on farmerrights.

Theory

UNIT - 1 Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.

UNIT - II Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.

UNIT – 3 Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

UNIT - 4 Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights.

UNIT - 5 Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Lecture Schedule

1. Introduction and meaning of intellectualproperty.
2. Introduction to GATT, WTO, TRIPs andWIPO.

3. Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty etc.
4. Types of Intellectual Property and legislations covering IPR in India.
5. Patents Act 1970 and Patent system in India.
6. Patent Cooperation Treaty, Patent search and patent database.
7. Origin and history including a brief introduction to UPOV.
8. Protection of plant varieties under UPOV.
9. PPV&FR Act of India.
10. Traditional knowledge-meaning and rights of TK holders.
11. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA).
12. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

COURSE OUTCOMES

- Knowledge of intellectual property.
- Knowledge of legislations covering IPR in India.
- Clear understanding of breeders, researcher and farmers rights.

Suggested Readings

- Fundamentals of Intellectual Property (English) 1st Edition (Paperback, Dr. Kalyan C. Kankanala), Publisher: Asia Law House ISBN: 9789381849514, 938184951X
Edition: 1st Edition, 2012
- Universal's Guide to Patents Law (English) 4th Edition (Paperback, MANISH ARORA) -
Publisher: Universal Law Publishing House ISBN: 9788175345836, 8175345837
Edition: 4th Edition, 2007.

APPLIED HI-TECH HORTICULTURE CREDIT 3 (2+1)

DEPARTMENT: ELECTIVE COURSE

COURSE OBJECTIVE:

- Give basic knowledge nursery management and their mechanization.
- Give basic knowledge of micro irrigation systems, canopy management and high density orchard.
- To give the basic knowledge mechanized harvesting of produce.
- To give the knowledge based on Remote Sensing, Geographical Information System.

Theory

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

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

UNIT-III Micro irrigation systems and its components: EC, pH based fertilizer scheduling canopy management, high density orcharding , Components of precision farming.

UNIT-IV Remote Sensing, Geographical Information System (GIS), Differential Geo - positioning System (DGPS).

UNIT-V Variable Rate applicator (VRA), application of (S NIN111SI4y precision farming in horticultural crops), mechanized harvesting of produce.

Practical

1. Types of polyhouses and shadehouses.
2. Intercultural operations, tools and equipments.
3. identification and application, micro propagation, nursery portrays, micro - EC, pH based fertilizers scheduling
4. Canopy management.
5. Visit to hi-tech orchard nursery.

COURSE OUTCOME:

- Give basic knowledge nursery management and their mechanization.
- Give basic knowledge Micro irrigation systems, canopy management and high density orcharding.
- To give the basic knowledge mechanized harvesting of produce.
- To give the knowledge based on Remote Sensing, Geographical Information System.

Suggested Readings

Text Books

- Cruses, W.V. 1958. Commercial Fruit and Vegetable products. IV (ed) The Mc. Graw – Hill Book Company, London.
- Mitra, S. K. 1997. Postharvest Physiology and Storage of Tropical Fruits CAB International UK.
- Panastico, B.M 1975. Postharvest physiology, handling and utilization of Tropical and sub-tropical Fruits and Vegetables. The AVI Publishing Company, INC

Reference Books

- Ranganna, S. 1977. Manual of analysis of fruits and vegetables products. Tata Mc. Graw Hill Publishing Company, New Delhi.
- Purseglove, J.W. et al 1981. Spices, Longman, New York (2 vols).

PRACTICAL CROP PRODUCTION-I (KHARIF CROPS) CREDIT 2 (0+2)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

Better knowledge for the cultivation of growing *Kharif* season crops.

To identify the different weed species in *Kharif* season crops.

To study the basic elements of crop production and their role in economy.

To study the requirement of new technology for commercial based cultivation.

Practical

1. Crop planning, raising field crops in multiple cropping systems.
2. Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops,
3. Harvesting, threshing, drying, winnowing, storage and marketing of produce.
4. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies.
5. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

COURSE OUTCOME:

To study best cultivation use in cultivation of rabi crops

To impart knowledge on Eugenics and animal roles in agriculture.

To able cost effective crops for increase economic level of India.

To calculate the accurate doses of herbicides and pesticide application in crops.

To study about the NUE increase in rabi season crops.

References:

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

SEMESTER VI / THIRD YEAR

Sr. No.	Subject Code	Subject Name	Credit
1.	ABAG-608	Rainfed Agriculture & Watershed Management	2 (1+1)
2.	ABAE-604	Protected Cultivation and Secondary Agriculture	2 (1+1)
3.	ABPP 604	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)
4.	ABHO-605	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
5.	ABEN-603	Management of Beneficial Insects	2 (1+1)
6.	ABGP 605	Crop Improvement-II (<i>Rabi Crops</i>)	2 (1+1)
7.	ABAG-609	Practical Crop Production –II (<i>Rabi Crops</i>)	2 (0+2)
8.	ABAG-610	Principles of Organic Farming	2 (1+1)
9.	ABEC-604	Farm Management, Production & Resource Economics	2 (1+1)
10.	ABFN-601	Principles of Food Science and Nutrition	2(2+0)
11.	ABEL-603	Agriculture Business Management (Elective Course)	3 (2+1)
12.	ABET 601	Educational Tour	2 (0+2)
		Total	26(13+13)

RAINFED AGRICULTURE & WATERSHED MANAGEMENT

CREDITS 2(1+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- To study about soil and water conservation techniques.
- To study about contingent crop planning for aberrant weather conditions.

To solution the problems and prospects of rainfed agriculture in India.

Theory

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

Practical

1. Studies on climate classification,
2. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
3. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.
4. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.

5. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation.
6. Studies on cultural practices for mitigating moisture stress.
7. Characterization and delineation of model watershed.
8. Field demonstration on soil & moisture conservation measures.
9. Field demonstration on construction of water harvesting structures.
- 10.** Visit to rainfed research station/watershed.

Lecture schedule:

1. Rainfed agriculture- definition, history and its importance in India with particular reference Rajasthan
2. Problems of dryland agriculture related to climate, soil, technological and socio economic conditions
3. Soil and water conservation techniques,
4. Drought: types,
5. effect of water deficit on physio- morphological characteristics of the plants,
6. Use of anti transpirants-their kind, mode of action and effect on crop yield.
7. Crop adaptation and mitigation to drought;
8. Water harvesting: importance, its techniques,
9. Efficient utilization of water through soil and crop management practices,
10. Water harvesting techniques in dry farming areas
11. Watershed management- concept, definition, objectives and principles
12. Integrated watershed management for drylands
13. A study of model watershed area
14. Management of crops in rainfed areas,
15. Contingent crop planning for aberrant weather conditions,
16. Alternate cropping and land use strategies for dryland agriculture

COURSE OUTCOME:

- Knowledge about mulching and its effects on soil moisture conservation.
- Knowledge about new water harvesting techniques.
- To solve the problems of dry land agriculture related to climate, soil, technological and socio economic conditions.

References:

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

PROTECTED CULTIVATION AND SECONDARY AGRICULTURE CREDIT 2(1+1)

DEPARTMENT: AGRICULTURAL ENGINEERING

COURSE OBJECTIVE:

- To study about greenhouse equipments materials of construction for traditional and low cost greenhouses.
- To study of irrigation systems used in greenhouses.
- To study about drying and dehydration, moisture measurement, EMC, drying theory, various drying method and commercial grain dryer.

Theory

UNIT - I 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 - II Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, greenhouse drying.

UNIT - III 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 - IV 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 - V Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

1. Study of different type of greenhouses based on shape.
2. Determine the rate of air exchange in an active summer winter cooling system.
3. Determination of drying rate of agricultural products inside greenhouse.
4. Study of greenhouse equipments. Visit to various Post Harvest Laboratories.
5. Determination of Moisture content of various grains by oven drying & infrared moisture methods.
6. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).
7. Determination of Moisture content of various grains by moisture meter.
8. Field visit to seed processing plant.

Lecture schedule:

Introduction to green house technology, types of green houses and climate control inside green house.

1. Planning and design of greenhouses.
2. Design criteria of green house for cooling and heating purposes and greenhouse equipments
3. Materials of construction for traditional and low cost greenhouses
4. Irrigation systems used in greenhouses
5. Naturally ventilated solar green house, high tech greenhouse
6. Use of green house in drying.
7. Concept and construction of low tunnels. Use of shade net house in protected cultivation.
8. Important engineering properties such as physical, thermal dynamic aero & hydrodynamic of cereals, pulses and oil seed.
9. Concepts of cleaning and grading vibratory and rotary type air cleaner.
10. Drying and dehydration: Moisture measurement, EMC, drying theory, various drying methods.
11. Commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer).
12. Material handling equipment: conveyers and elevators, their principle, working and selection.

COURSE OUTCOME

- Knowledge about low cost green house equipments.
- Awareness of irrigation systems used in greenhouses.
- Understanding of drying and dehydration, air cleaner and grain dryer.

Suggested Reading :

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. AgroTech 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 Wiley and Sons, New York.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT-II

3(2+1)COURSE CODE :ABPP 604

Course objective

- To obtain knowledge of Wheat, Sugarcane, Sunflower Mustard, Gram, etc. Diseases of fieldcrops.
- To study disease of horticulture crops Mango, Citrus, Apple, etc. and theirmanagement

Theory:

Symptoms, etiology, disease cycle and management of major diseases of following crops

(A) Fieldcrops

UNIT-1 Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng

UNIT-2 Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mouldand Ascochyta blight; Lentil: rust and wilt.

UNIT-3 Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

(B) Horticulture crops

UNIT-4 Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot

UNIT-5 Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leafspot.

Lectures Schedule: Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

S.N	Topic	No. of lectures
1	Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle.	03
2	Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng	02
3	Sunflower: Sclerotinia stem rot and Alternaria blight	01
4	Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot.	02
5	Gram: wilt, grey mould and Ascochyta blight	01
6	Lentil: rust and wilt;	01
7	Cotton: anthracnose, vascular wilt, and black arm	02
8	Pea: downy mildew, powdery mildew and rust..	01
9	Mango: anthracnose, malformation, bacterial blight and powdery mildew	02
10	Citrus: canker and gummosis.	01
11	Grape vine: downy mildew, Powdery mildew and anthracnose.	02
12	Apple: scab, powdery mildew, fire blight and crown gall;	02
13	Peach: leaf curl, Strawberry: leaf spot	01
14	Potato: early and late blight, black scurf, leaf roll, and mosaic	02
15	Cucurbits: downy mildew, powdery mildew, wilt	02
16	Onion and garlic: purple blotch, and Stemphylium blight	01
17	Chilies: anthracnose and fruit rot, wilt and leaf curl	02
18	Turmeric: leaf spot, Coriander: stem gall	02
19	Marigold: Botrytis blight, Rose: dieback, powdery mildew and black leaf spot	02
	Total	32

Lecture Schedule: 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.

S.N	Topic	No. of lectures
1	Wheat: Rusts, loose smut, karnal bunt and ear cockle	02
2	Sugarcane: Red rot, smut, grassy shoot, ratoon stunting	01
3	Sunflower: Alternaria blight, Stem rot & Mustard: White rust	01
4	Gram: Wilt, Ascochtablight, Lentil : Rust & Pea: Powdery mildew	01
5	Cotton: Vascular wilt & Black arm	01
6	Mango: Malformation, bact. blight & Powdery mildew	01
7	Citrus: canker, Gummosis & Grape vine: Downy and powdery mildew	01
8	Apple: Scab, Fire blight, crown gall, Peach: leaf curl & Strawberry: leaf spot	01
9	Potato: Early & Late blight, Black scurf, mosaic	01
10	Cucurbits: Downy and powdery mildew, wilt	01
11	Onion & Garlic: purple blotch & stemphylium wilt	01
12	Chillies: Anthracnose, fruit rot, wilt & leaf curl	01
13	Turmeric: leaf spot & Coriander: Stem gall	01
14	Rose: powdery mildew, dieback & Marigold: botrytis blight	01
15	Field visit to diagnose the diseases and collect of disease specimen	01
	Total	16

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

COURSE OUTCOME

- Knowledge of disease cycle and management of fieldcrops.
- Knowledge of symptoms, disease cycles of horticulturecrops.

Suggested Reading:

Text Books

1. Gupta V K and Paul, Y S 2008. IInd ed. Diseases of field crops. Kalyani PublishingCo.ND.
2. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata Mc Graw-Hill Publishing Co Ltd.ND.
3. Rangaswamy, Gand Mahadevan, A. 2012. 4th ed. Diseases of crop plants in India. Prentice hall of India

Pvt. Ltd, New Delhi.

4. Singh R S .2007. 8thed. Plant Diseases. Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi
5. Gupta, V. K. 2014. Diseases of Fruit Crops. KalyaniPublishers
6. Chaube H.S. Crop Diseases and Their Management.PHI
7. Singh , R.P. 2013. Plant Pathology. KalyaniPublishers
8. Tripathi, D.P. 2009. Crop Diseases, KalyaniPublishers
9. Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd,NewDelhi.
10. Singh, R.S. 2006. Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. Cook, A. A. 1981. Diseases of tropical and sub-tropical field fiber and oil plants. Mac Millan Publishing Co.NewYork.
2. Mishra A, Bohra A and Mishra, A. 2005. Plant Pathology. Agrobios. Jodhpur(India).
3. Singh R S .2007. Plant Diseases.(9th Ed.) Oxford and IBH Publishing Co. Pvt.Ltd.ND
4. Gangawane, L.V. and Khilare, V.C. 2008. Crop diseases identification and management. Daya publishing house, NewDelhi.

POST-HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES CREDITS 2(1+1)

DEPARTMENT: HORTICULTURE

COURSE OBJECTIVE:

- To study about the post-harvest processing of fruits and vegetables.
- To study about the harvesting and storage of fruits and vegetables.
- To study about packaging of products (Jam, jelly, marmalade, preserve, candy).

Theory

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

Practical

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

Lecture schedule:

1. Importance of post-harvest processing of fruits and vegetables
2. Extent and possible causes of post harvest losses
3. Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening
4. Respiration and factors affecting respiration rate
5. Maturity indices, Harvesting and field handling
6. Storage (ZECC, cold storage, CA, MA, and hypobaric)
7. Value addition concept; Principles and methods of preservation
8. Intermediate moisture food- Jam, jelly, marmalade
9. Preserve, candy- Concepts and Standards
10. Fermented and non-fermented beverages
11. Tomato products- Concepts and Standards
12. Drying/ Dehydration of fruits and vegetables- Concept and methods, osmotic drying
13. Canning- Concepts and Standards, packaging of products

COURSE OUTCOME

- The acquired knowledge about the value addition (fruit & vegetable preservation).
- The get knowledge about the post harvest technology of fruit and vegetables.
- The get knowledge about fermented and non fermented beverages.

Text Books

1. Jacob John, P A Handbook on Post Harvest management of Fruits and vegetables (2008), Daya Publishing House, Delhi.
2. Morris, T. N. Principles of Fruit Preservation (2006) Biotech Books, Delhi
3. Srivastava, R. P. & Sanjeev Kumar Fruits and vegetable Preservation- Principles and Practice (2002) International Book Distributing Co., Lucknow.

References:

- Battacharjee, S. K. and De, L. C Post Harvest Technology of Flowers and Ornamentals Plants (2005) Pointer Publisher.
- Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International.
- Manoranjan, K and Sangita, S. Food Preservation & Processing (1996) Kalyani Publishers
- Saraswathy, S. ET. Al. Post harvest Management of Horticultural Crops (2008) Agribios

MANAGEMENT OF BENEFICIAL INSECTS CREDITS 2(1+1)

DEPARTMENT: ENTOMOLOGY

COURSE OBJECTIVE:

- To study about the best method of beekeeping.
- To study about the rearing, biology of silkworm, predators and parasitoids.
- To study about the morphology of lac insect.

Theory

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

UNIT - II Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting, preservation of leaves. rearing, mounting and harvesting of cocoons and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

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

UNIT - IV 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.

UNIT-V Important species of pollinator, role of pollinators in cross-pollinated plants, weedkillers and scavengers with their importance.

Practical

1. Honey bee species, castes of bees. Beekeeping appliances.
2. Seasonal management, bee foraging and communication.

3. Study about and natural enemies and disease of Honeybee.
4. Types of silkworm, voltinism and biology of silkworm.
5. Mulberry cultivation, its varieties, methods of harvesting and preservation of leaves
6. Species of lac insect, host plant identification.
7. Identification of other important pollinators, weed killers and scavengers.
8. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.
9. Identification and techniques for mass multiplication of natural enemies.

Lecture Schedule:

1. Beekeeping- Importance, bee species and biology.
2. Commercial methods of rearing, equipment used, seasonal management.
3. Bee enemies and diseases.
4. Bee pasturage, bee foraging and communication.
5. Importance, species of silkworm, voltinism and biology.
6. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.
7. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm.
8. Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac- products.
9. Insect orders bearing parasitoids and predators used in pest control.
11. Important species of pollinators, weed killers and scavengers with their importance.

COURSE OUTCOME

- Gain the knowledge of beneficial insects and their economic importance.
- Knowledge of method and use of the equipments for rearing and production of the honey, silk and lac.
- Identified of the different beneficial insects.

Suggested Reading:

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., NewDelhi.

3. Dhaliwal, GS &Koul O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.
4. Gautam, R.D. Biological Pest Suppression, WestvillPublising Co.,NewDelhi.
5. Manfred Mackaur, Laster E.Ehlerand Jens Roland. 1990. Critical Issues in Biological control- Intercept Ltd. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. TechnicalBulletin-4.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I,Kalyani Publishers,NewDelhi.
7. Abrol,D.P.2013.Beekeeping:A Comprehensive Guide to Bee,Beekeeping, Scientific Publishers,Jodhpur.

CROP IMPROVEMENT – II (RABI CROPS)

CREDITS 2 (1+1)

DEPARTMENT: GENETICS AND PLANT BREEDING

COURSE OBJECTIVE:

1. To study about the improvement of various crops.
2. To study about the genetics resource of crops.
3. To study about the hybrid seed production.

Theory

UNIT-I Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds fodder crops and cash crops.

UNIT-II Centers of origin, distribution of species, wild relatives in different vegetable and horticultural crops; Plant genetic resources, its utilization and conservation.

UNIT – III Study of genetics of qualitative and quantitative characters Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional).

UNIT – IV Hybrid seed production technology of rabi crops.

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

Practical

1. Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion.
2. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed descent methods.

3. Study of field techniques for seed production and hybrid seeds production in *Rabi* crops.
4. Estimation of heterosis and inbreeding depression
5. Estimation of heritability.
6. Layout of field experiments.
7. Study of quality characters.
8. Study of donor parents for different characters.
9. Visit to seed production plots.
10. Visit to AICRP plots of different field crops

Lecture Schedule:

1. Crop improvement aspects in wheat as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
2. Crop improvement aspects in oat as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
3. Crop improvement aspects in barley as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
4. Crop improvement aspects in chickpea as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
5. Crop improvement aspects in lentil as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
6. Crop improvement aspects in field pea as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
7. Crop improvement aspects in rapeseed mustard as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
8. Crop improvement aspects in rapeseed mustard as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc & hybrid seed production
9. Crop improvement aspects in sunflower as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc.
10. Crop improvement aspects in berseem as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc & hybrid seed production
11. Crop improvement aspects in lucern as mentioned in the syllabus such as Centers of origin, distribution of species floral biology breeding objectives and procedures etc & hybrid seed

production

12. Op improvement aspects in sugarcane as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.
13. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
14. Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops
15. Climate resilient crop varieties for future

COURSE OUTCOME

- Acquired knowledge about improvement of various crops.
- To get knowledge about the hybrid seed production.
- To Acquired knowledge about the seed production technology.

Text Books

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi.
2. Mandal, A.K., P.K. Ganguli and S.P. Banerjee. 1991. *Advances in Plant Breeding* Vol. I and II. CBS Publishers and Distributors, New Delhi.
3. Sharma, A.K. 2005. *Breeding Technology of Crop Plants* (Edt.). Yash Publishing House, Bikaner.
4. Ram. H.H. 2005. *Vegetable Breeding — Principles and Practices*. Kalyani Publishers, New Delhi.

References:

1. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenty-First Century* (Edt). International Book Distributing Co. Lucknow.
2. Poehlman, J.M. 1987. *Breeding of Field Crops*. AVI Publishing Co... INC, East Port, Connecticut, USA.
3. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics*. Kalyani Publishers, New Delhi.

PRACTICAL CROP PRODUCTION-II (RABI CROPS)

CREDITS 2 (0+2)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- To study the field preparation and sowing methods.
- To study moisture conservation practices.
- To study the seed treatment methods.

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.

Practical schedule

- Crop planning, raising field crops in multiple cropping systems
- Selection of crops and varieties
- Seed treatment
- Preparation of seed bed and sowing of crops and Thinning and gap filling
- Fertilizer application including top dressing of fertilizers
- Intercultural operations- hoeing and weeding
- Application of moisture conservation practices
- Insect and pest management /control –application of insecticides.
- Disease management/control –application of fungicides
- Harvesting of the crops, Threshing, winnowing and storage and Marketing of produce

- Preparation of balance sheet including cost of cultivation and net return per student as well as team of a group of student.

COURSE OUTCOME:

- To knowledge the field preparation, fertilizer application and sowing methods.
- To awareness moisture conservation methods.
- To understanding the hoeing and weeding methods.

References:

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

PRINCIPLES OF ORGANIC FARMING CREDITS 2(1+1)

DEPARTMENT: AGRONOMY

COURSE OBJECTIVE:

- To study the concept of organic farming.
- To basis study of certification process and standards of organic farming.
- To study about processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Theory

UNIT-I Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.

UNIT - II Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming Choice of crops and varieties in organic farming.

UNIT-III Fundamentals of insect, pest, disease and weed management under organic mode of production.

UNIT-IV Operational structure of NPOP; Certification process and standards of organic farming.

UNIT-V Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

Lecture Schedule:

1. Organic farming, principles and its scope in India;
2. Initiatives taken by Government(central/state), NGOs and other organizations for promotion of organic agriculture;
3. Organic ecosystem and their concepts;
4. Organic nutrient resources and its fortification;
5. Restrictions to nutrient use in organic farming;
6. Choice of crops and varieties in organic farming;
7. Fundamentals of insect, pest, disease mgt
8. Weed management under organic mode of production;
9. Operational structure of NPOP
10. Certification process and standards of organic farming;
11. Processing, leveling, economic considerations and viability.
12. Marketing and export potential of organic products.

Text Books

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. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agritech, Publishing Academy, Udaipur.

References:

- Organic Farming for sustainable Agriculture S.C.Panda
- Palaniappan, S.P. and Anandurai, K. 1999. Organic Farming—Theory and Practical. Scientific Pub. Jodhpur

FARM MANAGEMENT & RESOURCE ECONOMICS

CREDITS 2 (1+1)

DEPARTMENT: AGRICULTURAL ECONOMICS

COURSE OBJECTIVE:

- To understand the factor determining types and size of farms.
- To calculate the gross and net farm income.
- To study the balance sheet and income statement.
- To know the farm planning and budgeting.

Theory

UNIT - I 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:

UNIT - II Concept of production function and its type, use of production function in decision making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. 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.

UNIT - III Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.

UNIT - IV Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies,

Crop/livestock/machinery insurance-weather based crop insurance, features, and determinants of compensation.

UNIT-V Concepts of resource economics, differences between NRE and agricultural

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

Practical

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

Lecture Schedule:

1. Meaning and concept, objectives and relationship with other sciences Meaning and definition of farms, its types and characteristics, factor determining types and size of farms.
2. 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,
3. Law of equi-marginal/or principles of opportunity cost and law of comparative advantage.
4. Meaning and concept of cost, types of costs and their interrelationship
5. Importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income Farm business analysis
6. Meaning and concept of farm income and profitability, Technical and economic efficiency measures in crop and livestock enterprises
7. 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

- 8 Meaning and importance of farm planning and budgeting, partial and complete Steps in farm planinig andbudgeting
- 9 Linear programing, appraisal of farm resources, selection of crops and livestock"s enterprises. Concepts of risk anduncertainty
- 10 Concept of risk and uncertainty occurs in agriculture production, Nature and sources of risks and its management strategies Concepts of resourceeconomics
11. Differences between NRE and agricultural economics unique properties of naturalresources

COURSE OUTCOME

- Clear understanding crop and livestockenterprises
- Knowledge of different types of farms
- Knowledge of farm inventory and factor-productrelationship
- Determination of least cost combination ofinputs.

References:

1. Bhavani Devi,P. Raghu Ram,S. SubbaReddy,T.V. NeelakantaSastry, 2009, Agricultural economics, Oxford and IBH Co. Pvt. Ltd., ,NewDelhi.
2. Johl, S.S. and T.R. Kapur, 1989, Fundamentals of Farm Business Management,Kalyani Publishers,Ludhiyana.
3. Kerr, John M., et al., 1997, Natural Resource Economics: Theory and Applications in India, Oxford & IBH,NewDelhi.
4. Raju,V.T.andD.V.S.Rao,2002,"EconomicsofFarmProductionandManagement",Oxford and IBH Publishing Co. Pvt. Ltd.,NewDelhi.
5. Sankhayan, P. L., 1988, Introduction to the Economics and Agricultural Production,Prentice Hall of India Private Limited, NewDelhi.
6. Singh, I. J., 1977, Elements of Farm Management Economics, Affiliated East-West Press Pvt. Ltd.,NewDelhi.
7. Dhondyal, S.P. (1985), Farm Management, Friends Publication Meerut(India).

PRINCIPLES OF FOOD SCIENCE AND NUTRITION

CREDIT 2(2+0)

DEPARTMENT: FOOD SCIENCE & TECHNOLOGY

COURSE OBJECTIVE:

- To study about the foodScience.
- To study about the composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, importantreactions).
- To study the processing and preservation (use of heat, low temperature, chemicals, radiation, dryingetc.).
- To study the energy metabolism of carbohydrate, fat,proteins.

Theory

- UNIT-I** Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systemsetc.).
- UNIT-II** Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins,minerals, flavours, colours, miscellaneous bioactives, importantreactions).
- UNIT-III** Food microbiology (bacteria, yeast, moulds, spoilage of fresh &processed foods, Production of fermentedfoods);
- UNIT-IV** Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, dryingetc.).
- UNIT - V** Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, M enu planning, Newtrends in food science and nutrition.

Lecture Schedule:

1. Concepts of Food Science (definitions, measurements, density,phase change, pH,osmosis, surface tension, colloidal systemsetc.).

2. Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).
3. Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods).
4. Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).
5. Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat proteins).
6. Balanced/ modified diets, Menu planning.
7. New trends in food science and nutrition.

COURSE OUTCOME

- Explain the chemistry underlying the properties of various food components.
- Knowledge the major chemical reactions that occur during food preparation and storage.
- Knowledge the important pathogens and spoilage microorganisms in foods.

Suggested Reading:

Text Books

1. Srilakshmi, B. (2010). Text Book of Food Science. New age international (P) limited, publisher, New Delhi
2. Sehgal, S. and Raghuvanshi, R.S. (2007). Text Book of Community Nutrition, ICAR Publication
3. Swaminathan. M. (1993). Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore, p.576.

Reference Books

- Khaddar V., (1999). Text Book of Food. Storage and Preservation. Kalyani Publishers, New Delhi
- Srilakshmi, B. (2010). Text Book of Nutrition Science. New age international (P) limited, publisher, New Delhi

AGRI BUSINESS MANAGEMENT

CREDIT 3(2+1)

DEPARTMENT: ELECTIVE COURSE

COURSE OBJECTIVE:

- To study practical knowledge of agro based industries
- To study about working structure of agribusiness management.

Theory

UNIT-I. Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy.

UNIT-II Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.

UNIT-III Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation.

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

Lecture Schedule:

1. Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.
2. Importance of agribusiness in the Indian economy and New Agricultural Policy
3. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries
4. Classification of industries and types of agro based industries
5. Institutional arrangement, procedures to set up agro based industries
6. Constraints in establishing agro-based industries

7. Agri-value chain: Understanding primary and support activities and their linkages
8. Business environment: PEST & SWOT analysis.
9. Management functions: Roles & activities, Organization culture
10. Planning, meaning, definition, types of plans
11. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget
12. Components of a business plan, Steps in planning and implementation.
13. Organization staffing, directing and motivation
14. Ordering, leading, supervision, communications, control.
15. Capital Management and Financial management of Agribusiness
16. Financial statements and their importance
17. Marketing Management: Segmentation, targeting & positioning
18. Marketing mix and marketing strategies.
19. Consumer behaviour analysis, Product Life Cycle (PLC).
20. Sales & Distribution Management. Pricing policy, various pricing methods.
21. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.
22. Project Appraisal and evaluation techniques.

Practical

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

References:

1. Bhor. D. 1994. GATT Agreement or Dunkel Draft Treaty . Its impact on Agriculture Industry, TRIPS and TRIMS and Drug Industry, Mittal Publications , New Delhi
2. Cramer. G.L. and Jenson. C.W. 1979. Agricultural Economics and Agribusiness. John • Wiley & Sons, New York.
3. Gitteger Price , J. 1989 Economics Analysis of Agricultural Projects, John Hopkins • University Press, London
4. Harsh, S.B. Conner, U.J. and Schwab G.D. 1981 Management of the farm Business. • Prentice Hall Inc., New Jersey
5. Joseph, L. Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., • New Delhi
6. Omri Rawlins, N, 1980. Introduction to Agribusiness. Prentice Hall of India Pvt. Ltd., • New Delhi
7. Vaish, M. C. 1993. International Economics. Oxford • & IBH Publishing Co. Pvt. Ltd., New Delhi.

EDUCATIONAL TOUR CREDITS 2 (0+2)

DEPARTMENT: NON-GRADIAL COURSES

COURSE OBJECTIVE:

- Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

SEMESTER VII / FOURTH YEAR

S.No.	Rural Agricultural Work Experience and Agro Industrial Attachments (RAWE & AIA)		
	Activities	No. of Weeks	Credit Hours
1.	General orientation & On campus training by different faculties	01	14
2.	Village attachment/ Unit attachment in Univ./ College. KVK/ Research Station	13	
3	Plant Clinic	02	02
	Agro-Industrial Attachment	03	04
4.	Project Report Preparation, Presentation and Evaluation	01	
Total Weeks for RAWE & AIA		20	20

COURSE OBJECTIVES:

1. To provide an opportunity to the students to understand the rural setting in relation to agriculture and allied activities.
2. To make the students familiar with socio-economic conditions of the farmers and their problems.
3. To impart diagnostic and remedial knowledge to the students relevant to real field situations through practical training.
4. To develop communication skills in students using extension teaching methods in transfer of technology.
5. To develop confidence and competence to solve agricultural problems.
6. To acquaint students with on-going extension and rural development programmes.

Agro- Industrial Attachment: The students would be attached with the Agro industries for a period of 10 weeks to get an experience of the industrial environment and working.

RAWE Component-I

Village Attachment Training Programme

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

RAWE Component –II

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 10 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Postharvest-processing-value addition, Agri-finance institutions etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry.
- Study of various processing units and hands-on trainings under supervision of industry staff.
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry.
- Skill development in all crucial tasks of the industry.

Documentation of the activities and task performed by the student

Performance evaluation, appraisal and ranking of students.

Evaluation of RAWE Programme

Attendance: Minimum attendance – 85%

Records: Students would complete the record work/ report writing/ presentations, etc. based on daily field observations recorded in notebooks and weekly diaries maintained by them.

Evaluation Procedure: Students shall be evaluated component-wise under village attachment and agro-industrial attachment. The respective component In-Charge Instructor(s), agro- industrial official and Course Coordinator will evaluate the students as under:

ACTIVITY		Max. Marks
1. Village attachment training		
a.	KVK/ARS/NGO scientist	50
b.	Report Preparation	10
c.	University Committee (Presentation & Viva-voce)	40
2. Industrial attachment training		
a.	Industry officials	50
b.	Report Preparation	10
c.	University Committee (Presentation & Viva-voce)	40

Assessment Parameters (RAW & AIA):

S.No.	Parameters	Marks (%)
A.	Village Attachment	
	Regularity	10
	Initiative & creativity	10
	General conduct & discipline	10
	Work performance	20
B.	Industrial Attachment	
	Initiative & compliance	10
	General conduct and discipline	10
	Project planning & implementation	10
	Work performance	20

COURSE OUTCOME

1. Knowledge of rural setting in relation to agriculture and allied activities.
2. Acquaintance of socio-economic conditions of farmers and their problems.
3. Communication skills using extension teaching methods in transfer of technology.
4. Development of confidence and competence to solve agricultural problems.

SEMESTER VIII/ FOURTH YEAR

VIII Semester (Experiential Learning Programme/HOT)		
	Module	Credit Hr.
	1. Module-I	0+10
	2. Module-II	0+10
	Total	20 (0+20)

COURSE OBJECTIVES:

- To promote professional skills and knowledge through meaningful hands on experience.
- To build confidence and to work in project mode.
- To acquire enterprise management capabilities

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII semester.

S.N	VIIIth Semester (Experiential Learning Programme/ HOT)		
	Code	Module	Credit Hr.
1.	ABMO-801	Organic Production Technology	0+10
2.	ABMO-802	Commercial Beekeeping	0+10
3.	ABMO-803	Mushroom Cultivation Technology	0+10
4.	ABMO-804	Soil, Plant, Water and Seed Testing	0+10
5.	ABMO-805	Seed Production and Technology	0+10
6.	ABMO-806	Poultry Production Technology	0+10
7.	ABMO-807	Commercial Horticulture	0+10
8.	ABMO-808	Floriculture and Landscaping	0+10
9.	ABMO-809	Food Processing	0+10
10.	ABMO-810	Agriculture Waste Management	0+10
11.	ABMO-811	Production Technology for Bioagents and Biofertilizer	0+10
12.	ABMO-812	Commercial Sericulture	0+10

Evaluation of Experiential Learning Programme/ HOT

S.No.	Parameters	Max. marks
1 .	Project Planning and Writing	10
2 .	Presentation	10
3 .	Regularity	10
4 .	Monthly Assessment	10
5 .	Output delivery	10
6 .	Technical Skill Development	10
7 .	Entrepreneurship Skills	10
8 .	Business networking skills	10
9 .	Report Writing Skills	10
10.	Final Presentation	10
	Total	100

COURSE OUTCOME:

- Professional skills and knowledge..
- Confidence and working in project mode.
- Knowledge of enterprise management capabilities

ELECTIVE COURSES:

A student can select three elective courses out of the following and offer during 4th, 5th and 6th semesters.

S.N.	Courses	Credit Hours
1	Agribusiness Management	3(2+1)
2	Agrochemicals	3(2+1)
3	Commercial Plant Breeding	3(1+2)
4	Landscaping	3(2+1)
5	Food Safety and Standards	3(2+1)
6	Biopesticides & Biofertilizers	3(2+1)
7	Protected Cultivation	3(2+1)
8	Micro propagation Technologies	3(1+2)
9	Hi-tech. Horticulture	3(2+1)
10	Weed Management	3(2+1)
11	System Simulation and Agro-advisory	3(2+1)
12	Agricultural Journalism	3(2+1)

ELECTIVE COURSES CREDIT =03

1. Agri-business Management 3(2+1)

Theory

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. 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. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

2. Agrochemicals 3 (2+1)

Theory

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. 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. 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. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility—preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of 120 Report of the ICAR Fifth Deans' Committee water soluble P₂O₅ and citrate soluble P₂O₅ in single super phosphate. Estimation of potassium in Muriate 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.

3. Commercial Plant Breeding 3(1+2)

Theory

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. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. 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. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. 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.

4. Landscaping³⁽²⁺¹⁾

Theory

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. 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. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

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

5. Food Safety and Standards³⁽²⁺¹⁾

Theory

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. 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. Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods \ transgenics. 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.

6. Biopesticides & Biofertilizers 3(2+1)

Theory

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

Practical

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

7. Protected Cultivation 3(2+1)

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lily, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

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

8. Micro propagation Technologies 3(1+2)

Theory

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, 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 plants, 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 and generation of whole plants from different explants, Hardening procedures.

9. Hi-tech. Horticulture 3(2+1)

Theory

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS), 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.

10. Weed Management 3(2+1)

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. 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.

11. System Simulation and Agro-advisory 3(2+1)

Theory

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

12. Agricultural Journalism 3(2+1)

Theory

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. 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. 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. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proof reading, layouting.

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, proof reading, layouting. Testing copy with a readability formula. Visit to a publishing office.